Radio Shack ®
TRS-80
COLOR COMPUTER

Disk Graphics

SILVER PRICE

ACME PROFITS

QUARTERLY COMPARISON

BUDGET

A RENT
B FOOD
C CAR
D MISC
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Contents

Important Note!

Be sure your Color Computer is turned OFF *before* you insert or remove the Disk Drive Controller Pak; otherwise, damage to the Color Computer or Pak (or both) may occur.

Introduction

The TRS-80® Disk Graphics program lets you plot a variety of charts and display them on the Color Computer Screen or print them on a graphics printer.

With its multi-faceted chart-plotting capabilities, Disk Graphics has many practical, business, scientific, and engineering applications.

And, with its easy-to-follow menus and prompts, Disk Graphics lets you draw very sophisticated charts (as well as chart "keys") quickly and with a minimum of effort!

System Requirements . . .

To use Disk Graphics, you must have a:

- 16K (Radio Shack Catalog Number 26-3002) or 32K (26-3003) Color Computer which has Extended Color BASIC.

- Color television.

- Disk Drive and Disk Controller Pak™ (26-3022).

- COLOR TRSDOS 1.7 or later.

Optional equipment includes a:

- **Cassette Recorder.** Needed for loading charts created with the ROM version of your program.

- **Printer.** Disk Graphics can print charts on Radio Shack's dot-matrix printers that have graphics capabilities and the Color Graphics Printer (26-1192).

- **Additional Disk Drive** (26-3023).

About This Manual . . .

In this manual, we'll:

- give you a brief overview of Disk Graphics.

- go through a quick "practice session" demonstrating how to draw a Vertical Bar Chart.

- discuss each type of chart.

- talk about displaying/printing.

- discuss chart Features.

- tell you about saving and loading.

Each type of chart has a separate chapter. If you only want to plot and display:

- Pie Charts, read Chapters 1-5.

- Bar Charts, read Chapters 1-4 and 6.

- Line Charts, read Chapters 1-4 and 7.

- Key Charts, read Chapters 1-4 and 8.

- Point Charts, read Chapters 1-4 and 9.

We'll begin discussing Graphics right away and won't be reviewing any Color Computer terminology or syntax. If you want to review, refer to your manuals, *Getting Started with COLOR BASIC, Going Ahead with Extended COLOR BASIC,* and *Color Computer Disk System Owners Manual.*

Since Disk Graphics works in conjunction with your Printer (if you're printing out copies of the charts instead of just displaying them on the Screen), have your Printer's owner's manual handy as you read this manual.

A Few Notes About the Program

When any program is run under the control of COLOR TRSDOS, about 4K of RAM is required for COLOR TRSDOS, the text display buffer, and other system overhead. Disk Graphics needs about 7K of RAM for the graphic display buffer and other work space in RAM.

If you add up the overhead, you will see that there is only about 5K left in a 16K Color Computer for the program itself. However, Disk Graphics contains over 16K of machine-language instructions.

Disk Graphics gets around this problem by only loading into memory that part of the program it requires at any one time. Consequently, you'll notice a slight hesitation as new parts of the program are loaded. (If you're using a 32K Color Computer, you will not notice this since it can load more routines into memory.) This means that the Disk Graphics program diskette must remain in Drive 0 at all times. **Never remove the program diskette while using the program!**

The additional memory space a 32K unit has is used for an expanded printer buffer. Since the program can generate output for the Printer faster than the Printer can print it, this space is used to store printer output until the Printer can handle it.

Work Files

Disk Graphics allows nearly unlimited capacity for chart definition and features. However, since there is no room to keep this information in RAM, disk files are used to store chart data. Chart definitions are kept in the files called DEFWORK1/WRK and DEFWORK2/WRK. As you define a chart, a copy of your keystrokes is saved in one of those files. When you revise a chart, it is read back and the new version is written to the other file. This flip-flopping takes place automatically.

The features that are generated are stored in the file called FEAWORK/WRK.

The minimum amount of disk space that can be allocated to a file is one granule, or nine sectors of 256 bytes each. This is a total of 2,304 bytes of storage, more than enough for most definitions and sets of features. (Most definitions only require a few hundred bytes.) If you create a definition that requires more space than that, another gran (2,304 bytes) will be assigned to the work files.

Once space is allocated to a work file, it remains allocated forevermore. This insures that you will always have enough work space for your "worst case" situations. If the files are expanded because of an unusual situation (such as trying to find out how many charts you can display at once), you can exit the program and KILL the work files. The next time you run Disk Graphics, the work files will be recreated with only one gran of allocated space.

Disk Space Usage

COLOR TRSDOS requires 4 granules on Drive 0, Disk Graphics uses 8, and the work files usually require 3. This is a total of 15 granules which leaves 53 available for saving your chart definitions, etc. Since most definitions use 1 gran, you could save as many as 53 charts on a single diskette.

Definition and Feature Files

Definitions and features are stored in your disk files differently than they are stored in work files. To make them compatible with BASIC, they require twice as many bytes of space. This means that you can save 1,152 bytes of features or definitions in a file of yours. This is still more than enough for most charts. (Larger files will require two or more grans of disk space.)

1/ Getting Started

Before you install your Disk System, you need to connect your Color Computer to the T.V. If you haven't done it yet, refer to the **_TRS-80 Color Computer Operation Manual._** Then connect the Disk System.

Important Note: Your Computer must be OFF when you connect the Disk Drive Controller Pak or you could damage the Pak or your Color Computer.

Powering Up

After the system is set up:

1. Turn your T.V. ON.

2. Select channel 3 or 4.

3. Set the antenna switch on the T.V. to COMPUTER.

4. Turn the Computer ON. (The power button is on the left rear side of your keyboard.)

5. Turn the Disk Drive ON.

When everything is turned ON, this message should appear on your TV:

```
DISK EXTENDED COLOR BASIC v.r.
COPYRIGHT (C) 1981 BY TANDY
UNDER LICENSE FROM MICROSOFT
OK
```

(*v.r.* is a pair of numbers specifying which version and release you have.)

If not, turn the Computer OFF, check the connections, and power it up again. After powering-up the System, you can insert the Disk Graphics program diskette into Drive 0. (Be sure you don't turn the System ON or OFF with the disk in the drive.)

Now you're ready to begin.

Load the Disk Graphics program by typing RUN "DOS" and pressing ⒺⓃⓉⒺⓇ.

The yellow-and-red Main Menu of Disk Graphics will then appear on your Screen:

```
*****************************************
*           DISK GRAPHIC 1.4           *
*            COPYRIGHT 1982            *
*          ROBERT G. KILGUS           *
*        LICENSED TO TANDY CORP.       *
*          ALL RIGHTS RESERVED         *
*****************************************

1 CLEAR FEATURES
2 CREATE A CHART
3 LOAD INFORMATION
4 SAVE INFORMATION
5 EDIT FEATURES
6 DISPLAY RESULTS
7 EXIT PROGRAM
PRESS CHOICE NUMBER
(BREAK OR ENTER FOR MAIN MENU)
```
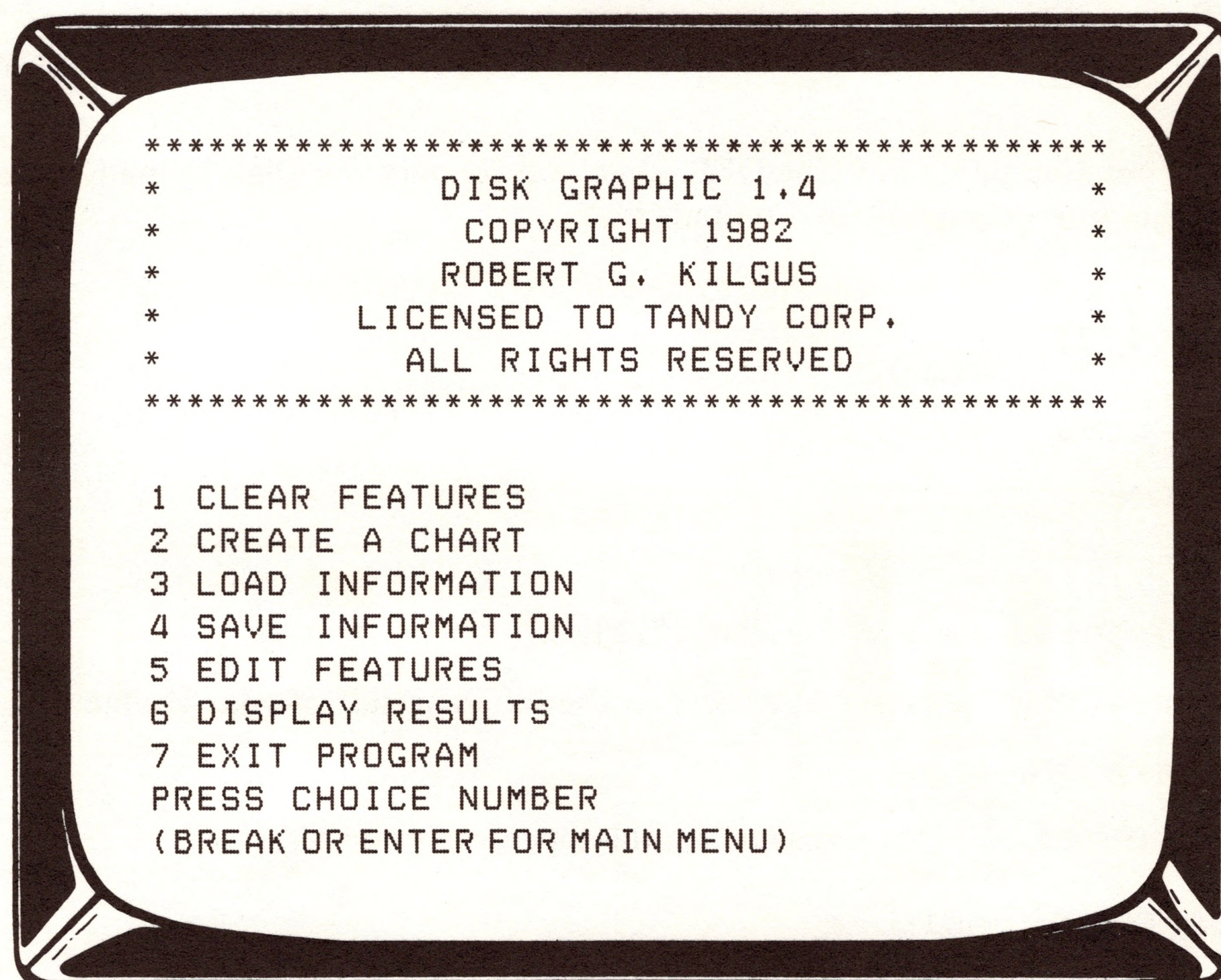
From this menu, you can start drawing charts.

2/ Program Overview

Disk Graphics gives you the choice of plotting five different types of charts:

- **Pie** draws a circular, "pie-shaped" chart that is divided into segments.

- **Bar** draws a chart with vertical or horizontal bars.

- **Line** draws a chart with points connected by a line.

- **Key** used in conjunction with another chart (also called a "legend"), defines what each type of line or bar in the chart represents.

- **Point** draws a chart with two scales (one vertical and one horizontal).

Pie	**Vert. Bar**	**Line**	**Key**	**Point**
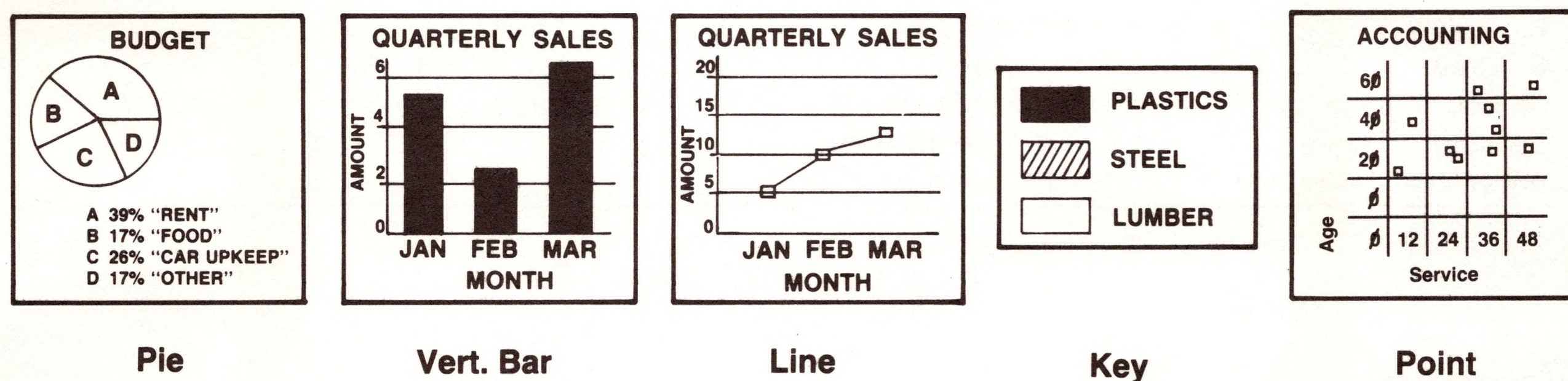
Figure 1.   Types of Charts

Charts can be displayed/printed on:

- Color Computer Screen — low or high resolution.

- Any Radio Shack dot-matrix printer that has graphics capabilities.

- Four-color Color Graphics Printer.

A special feature lets you print extra-wide charts over two sheets of paper on a dot-matrix printer (which you can attach with cellophane tape). Another feature lets you print extra-tall charts over two sheets of paper on the Color Graphics Printer.

Important Note: Never press RESET while using a Disk Graphics program diskette or work files will not be properly closed.

Hints and Tips . . .

Before you begin creating charts, here are some tips that will help you:

- (ENTER) If you don't know what to type next, press (ENTER). Disk Graphics usually supplies a "default value" for you.

- (BREAK) **to Main Menu** If you press (BREAK) or (ENTER) a couple of times, you'll always be returned to the Main Menu.

- **Double-checks** Disk Graphics always does a "double-check" before it begins printing or clearing information.

- **Defaults** Disk Graphics has default numbers for many chart prompts. You have the choice of either using these or entering new values.

- **Color Set** Disk Graphics' menus and prompts are displayed in yellow and red. Lowercase letters are red; uppercase letters are yellow, surrounded by red. Use (SHIFT) (0) to toggle between uppercase and lowercase modes.

- **Color Choices** 0 is usually the default value for the color choice. For a low- or high-resolution Screen and the Color Graphics Printer, the range for Color is 0-3, but each number defines a different color.

Low-Resolution Display	High-Resolution Display and Graphics Printer	Color Graphics Printer
0 red	0 black	Depends on the position
1 blue	1 dark gray	of the pen. Usually:
2 yellow	2 light gray	0, black; 1, blue; 2,
3 green	3 green	green; 3, red. All
(Green is the	(Green is the	colors are visible.
background color,	background color,	
not visible.)	not visible.)	

Table 1.   Color Choices

Errors

When you're ready to display a chart, an error message might be displayed on your Screen.

These error messages are unique to the Disk Graphics program and do not apply to Color BASIC programs.

After you have entered all the data to plot a chart, Disk Graphics does a self-check in memory (without displaying the chart on the Screen) to make sure the chart can be plotted and all titles fit on the chart. If the chart can't be plotted, the message is printed on the Screen. For an easy solution, see Appendix A, **Graphic Error Messages**.

Memory

There are two types of data in memory:

- **Chart Definitions** Prompts and values that define a chart.

- **Features** Internal instructions that describe a visual display in terms of the points, lines, boxes, arcs, and text strings from which it is made. (The internal "self-check" creates a set of features from the chart definition.)

Definitions and Features are saved and loaded into memory independently and in different ways (see Chapter 12, **Saving and Loading**).

3/ Sample Session

In this chapter you'll get some "hands-on" experience in drawing a Vertical Bar Chart.

Before you proceed further:

- Be sure your Color Computer and Disk System are properly connected.

- From the Main Menu, clear features by pressing ①②; the Main Menu will appear and memory will be cleared. There are seven choices on the menu.

  In this example, you will draw a Vertical Bar Chart that plots the trading price over a five-month period for the fictitious automotive firm, Acme Motor Company. These are the monthly average trading prices of the stock:

month	dollars per share
JAN	$38
FEB	$44
MAR	$51
APR	$41
MAY	$35

These are the steps:

1. Since you want to create a chart, display the Main Menu and press: ②.

2. The next menu asks if you want to revise a previous chart. Since you're building this chart from scratch (and not revising), press: ②.

3. This menu asks if it's okay to clear the previous definition. Press: ①.

4. The next menu gives you six choices for the type of chart you want to draw. Since you want a Vertical Bar Chart, press: ②.

5. Now there is a Screen full of prompts and the Cursor is at the position where you need to type in a name for your chart. Type: ACME MOTOR CO, STOCK. Press ⊕ five times and type:
   1 (ENTER) for SHADING. Use (SHIFT) (0) to type in uppercase mode.

6. You immediately get another Screen with more prompts.
   For SIDE LABEL, type: TRADING PRICE (this will be the label on the left side of the chart) and then press ⊕ once. The Cursor will be below BOTTOM LABEL. Now type: MONTH and press ⊕ once; the Cursor moves to the number of periods:

   ```
   PERIODS              [00001]
   ```

   To chart the price of the stock for five successive months, type: ⑤ (ENTER).

7. The next prompt asks you for the name of the first bar (NAME OF PERIOD 00001). Since you're charting months, make the first month JANuary (to save space on your charts, always use abbreviations).
   Type: JAN (ENTER).

8. This prompt asks for the name of the second bar. Type: FEB (ENTER). Repeat this procedure for MAR, APR, and MAY.

9. The next prompt asks you for the value of period 1 (JAN, the first month). This will be the JANuary trading price of Acme Motor Co. stock. Type: 38 (ENTER).

10. This prompt asks you for the value of period 2 (FEB, the second month). Type: 44 (ENTER). Repeat this procedure for MAR (51), APR (41), and MAY (35).

11. After you've entered all these values, you'll return to the Main Menu. Since you've entered all the required information for the chart, you can now display the chart on the Screen. To accomplish this, choose DISPLAY RESULTS from the Main Menu by pressing (6).

12. You now get a display menu with six choices. Each choice represents the possible display site. Display the chart on the Screen in high resolution. Press: (2). **Note:** Refer to the *Going Ahead with Extended COLOR BASIC* manual for more information on low and high resolution.

13. The last prompts are for the location of the display. Press (ENTER) and you'll get the default values.

The Screen is changed to Graphics and the chart is drawn. Since you pressed 1 on Shading, each bar is shaded on the Screen in black.

Even though there were a lot of steps in this procedure of drawing a chart, you'll soon be breezing through each menu and prompt as you become more familiar with Disk Graphics.

Size Reduction

Now display the chart, but reduce its size:

1. Press (BREAK) to get to the Main Menu.

2. From the Main Menu, press: (6).

3. From the display menu, press: (2).

4. On the display prompts, press (↓) twice. The Cursor moves to IMAGE SIZE REDUCTIONS.

5. Press: (1) (ENTER).

The display is drawn at one-half its original height and width. You can enter a value from 0 (full size, default) to 3 for the Image Size Reduction. Each value reduces the Screen in increments of 1/2. Press (BREAK) to return to the Main Menu.

Note: Resolution will decrease as images are reduced.
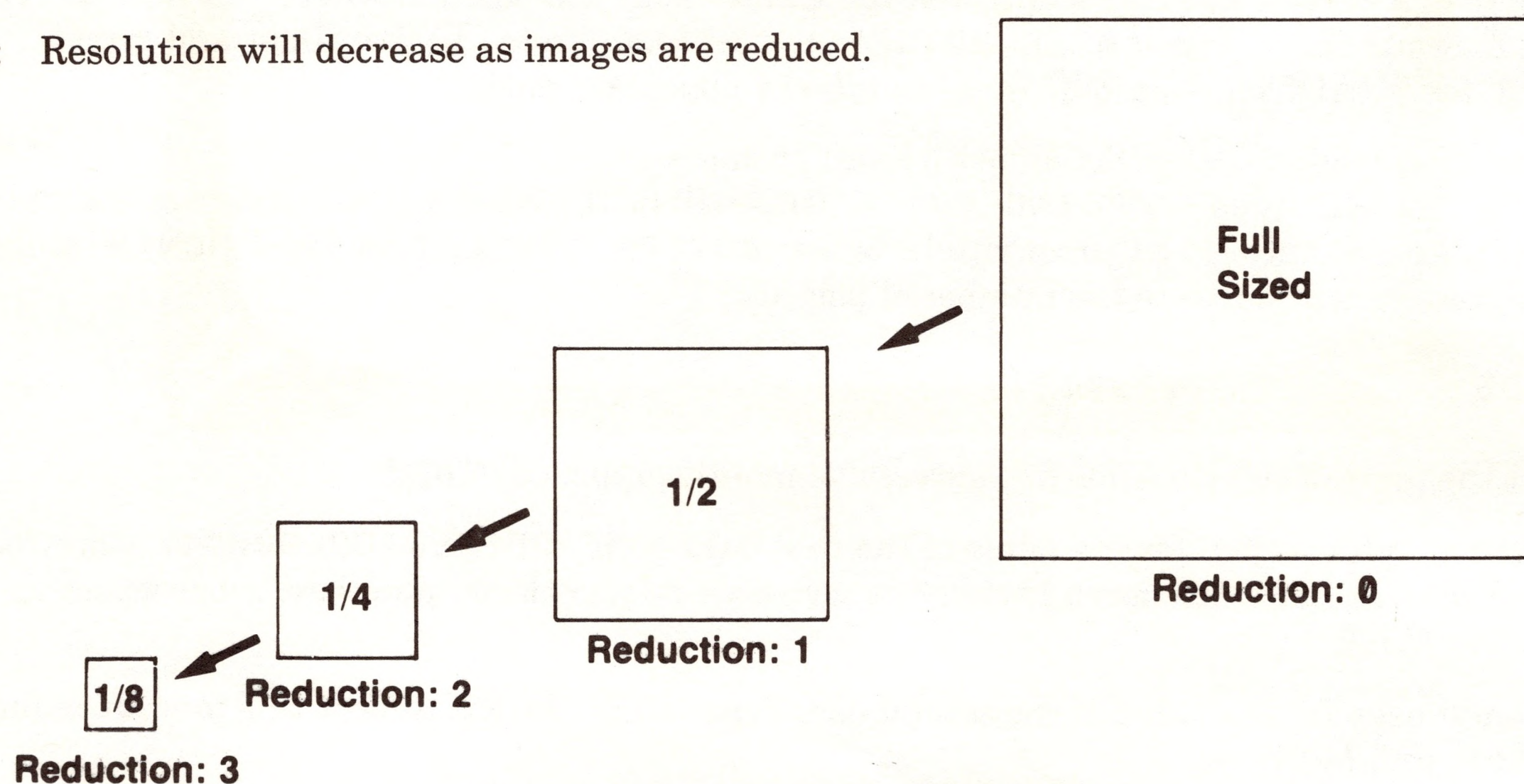
Figure 2.   Image Size Reductions

(For more information on Image Size Reductions, see Chapter 10, **Displaying/Printing**.)

4/ Menus and Prompts for Entering and Changing Data

The information provided in this chapter will explain how to input data to enter and change all types of charts (Pie, Bar, Line, Key and Point). Although each type of chart will be covered in detail in later chapters of this manual, the information in this chapter is basic to all of them.

There are two methods by which Disk Graphics asks for information:

- Menus

- Data Prompts

Menus

A menu is a listing of "types" of charts, displays, etc., like the Main Menu:

```
**********************************************
*              DISK GRAPHIC 1.4              *
*               COPYRIGHT 1982               *
*              ROBERT G. KILGUS              *
*            LICENSED TO TANDY CORP.         *
*             ALL RIGHTS RESERVED            *
**********************************************

1 CLEAR FEATURES
2 CREATE A CHART
3 LOAD INFORMATION
4 SAVE INFORMATION
5 EDIT FEATURES
6 DISPLAY RESULTS
7 EXIT PROGRAM
PRESS CHOICE NUMBER
(BREAK OR ENTER FOR MAIN MENU)
```
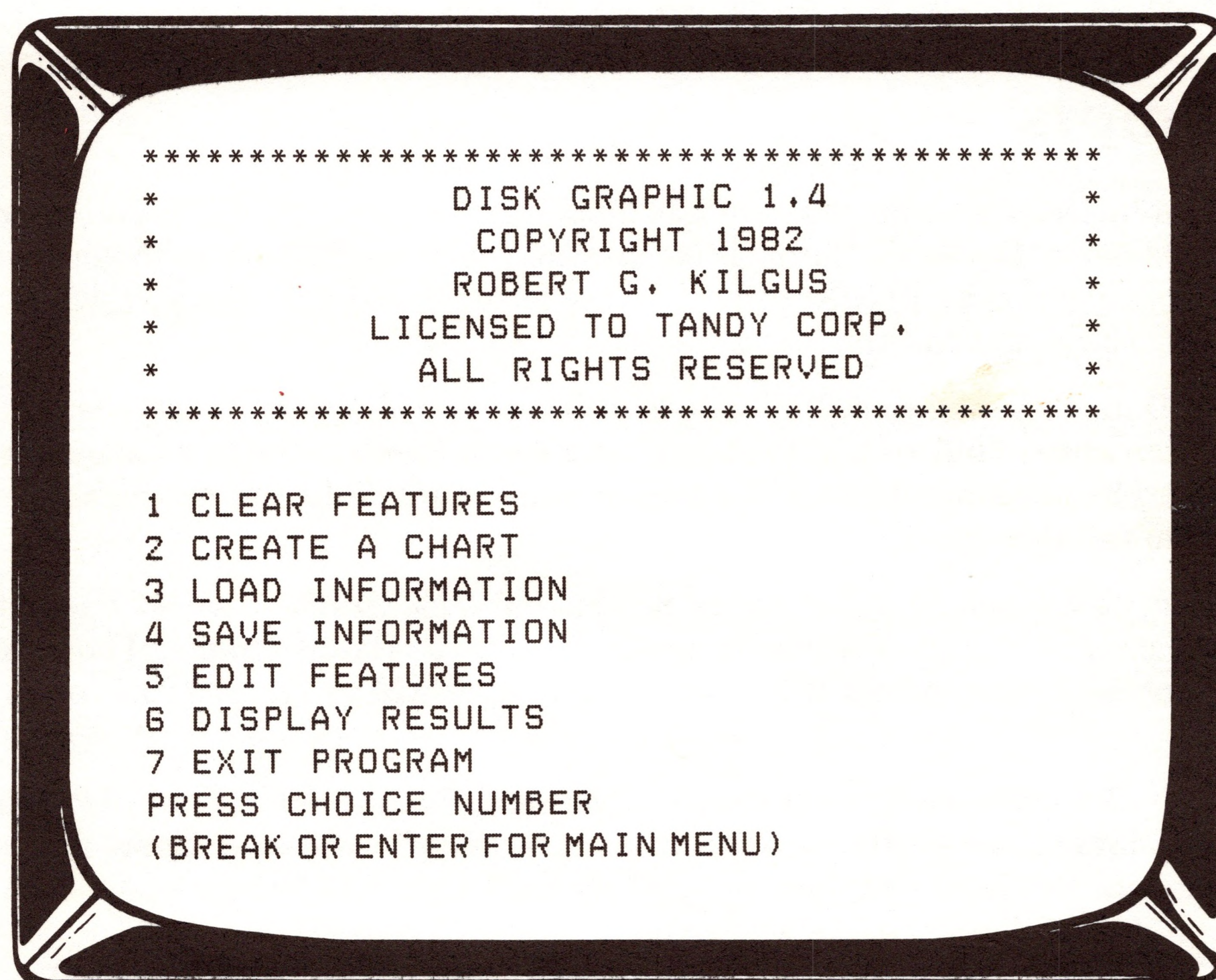
You have seven choices in this menu, including Menu Selection: 6 — the Display Method Menu:

```
DISPLAY METHOD?
1. 96X128    4 COLOR
2. 192X256   2 COLOR
3. 999X480   B/W PRINTER
4. B/W PRINTER (RIGHT HALF)
5. 480X999 4 COLOR PRINTER
6. COLOR PRINTER (UPPER 1/2)

PRESS CHOICE NUMBER
(BREAK OR ENTER FOR MAIN MENU)
```
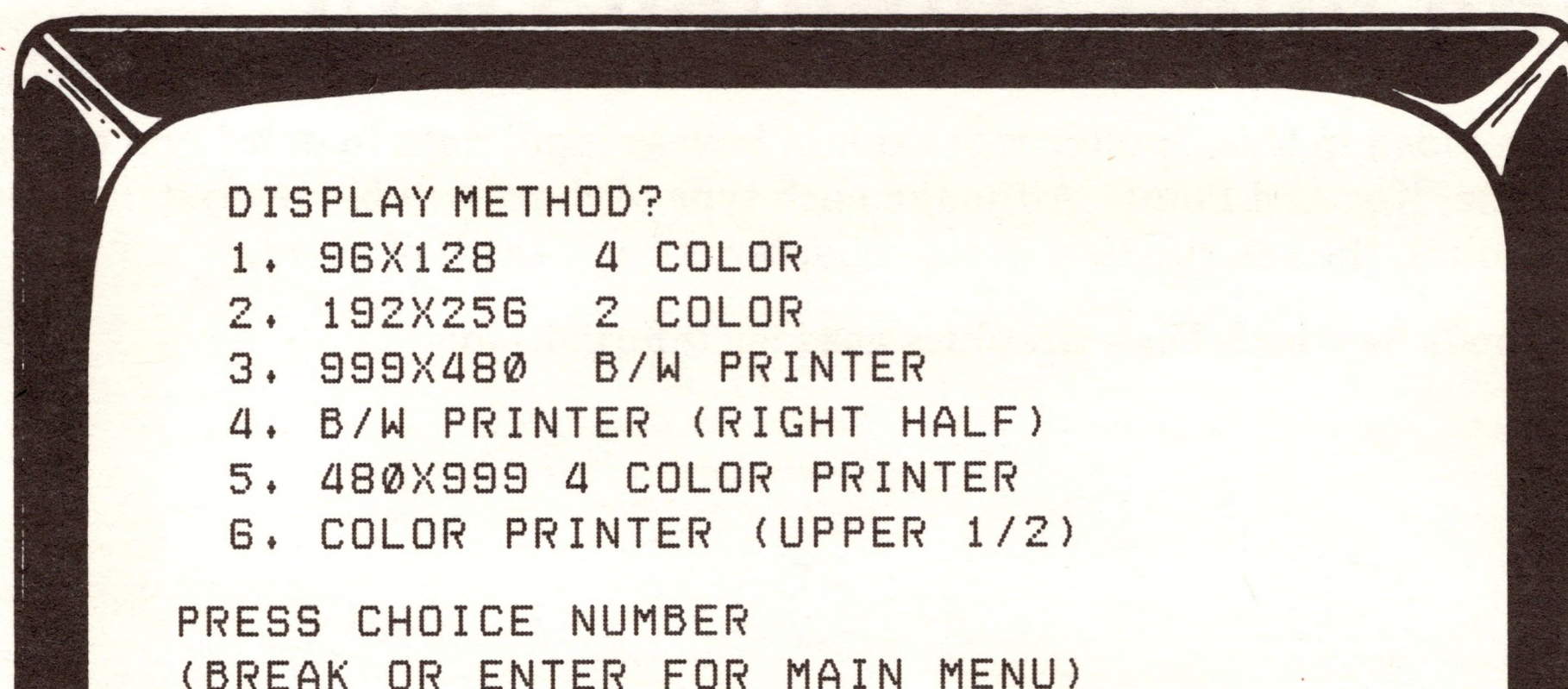
In this menu, you can choose 1, 2, 3, 4, 5, or 6, depending on the type of displaying/printing you want to do. Simply press the number and the command is accepted. If you make an invalid entry, Disk Graphics will cause the Computer to beep to indicate an error.

Data Prompts

Data Prompts are a series of prompts that are like a tax form — you must fill in each prompt or leave it blank if it's not applicable. Once this "form" is completed, you press (ENTER) and the form is entered into memory. Be sure you don't press (ENTER) until the entire form is completed the way you want it (although you can go back and edit the "form" later).
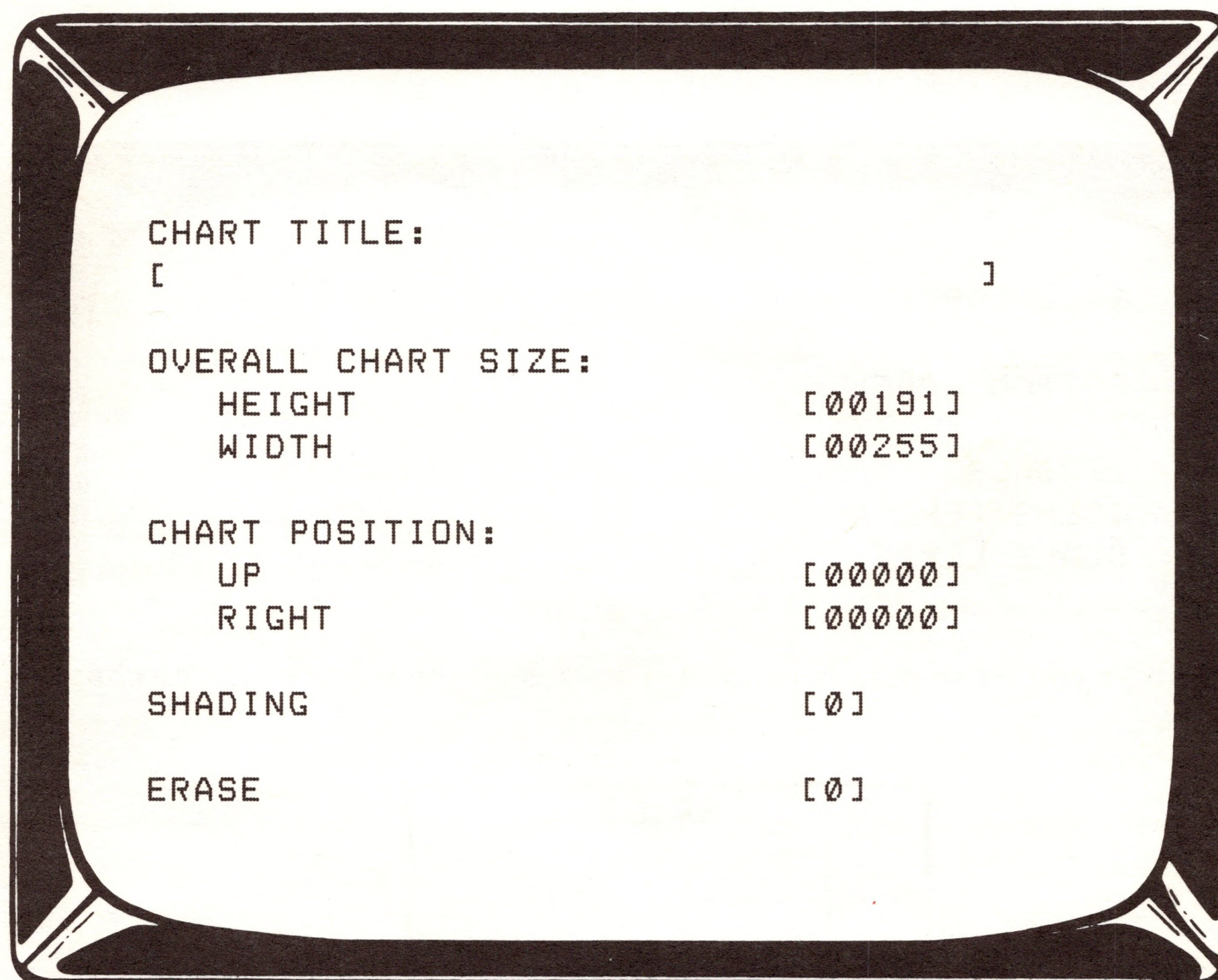
When you answer Data Prompts, you fill in values to decide a line's color, a chart's size, if you want shading, etc. You can always tell a Data Prompt from a menu because prompts have a blinking cursor (which can be moved by pressing (↑) or (↓)). There are also bracketed areas on the Screen that indicate the areas where you can type.

The ranges for prompts are not displayed on the Screen, but Disk Graphics will not accept any number which is not in the prompt's range. For example, in a Pie Chart's Data Prompts, if you press: (2) for shading, Disk Graphics will not accept the value and the input will be ignored (the range for shading is 0-1).

Some Data Prompts already have "default values". The default values for a chart are: height (191) and width (255). (These dimensions set the chart to fill a high-resolution Screen.) Chart dimensions can be changed but if they are not, Disk Graphics uses 191 for the height and 255 for the width.

Chart Data Prompts

To display the Chart Data Prompts, from the Main Menu press: ②②①①. These are the prompts you will see:

```
CHART TITLE:
[                                    ]


OVERALL CHART SIZE:
    HEIGHT                  [00191]
    WIDTH                   [00255]

CHART POSITION:
    UP                      [00000]
    RIGHT                   [00000]

SHADING                     [0]

ERASE                       [0]
```

CHART TITLE The alphanumeric text you enter here will be centered across the top of the chart. (Titles are not porportionally centered. If a title has an odd number of characters, the odd character is added to the left.) Disk Graphics prints the title as large as physically possible, as long as the title does not exceed 1/8 of the total chart height. The title must fit from left to right within the defined chart width.

OVERALL CHART HEIGHT Disk Graphics has a default of 191 (the largest height that can be seen with the high-resolution Screen). You can enter any value up to 999.

OVERALL CHART WIDTH Disk Graphics has a default of 255 (the largest width that can be seen with the high-resolution Screen). You can enter any value up to 999.

CHART POSITION This indicates the location of the lower-left corner of the chart on the 999 x 999 "Superscreen" (the Computer's internal drawing pad). The numbers indicate how many points up and to the right on the Superscreen that the chart will be displayed. Zeroes are the defaults since Disk Graphics normally displays as much as it can of the Superscreen's lower-left corner.

SHADING Shading is the solid coloring of a pie section, bar, etc., and depends on the type of chart used and the type of color set used. The range is 0 to 1. "Zero" draws outlines only and is the default value. "One" shades in outlines.

ERASE Erase is used when you want one chart to be placed on top of another (usually used with Key Charts, see Chapter 8). The range is 0 to 1. **Note:** If you use 1 for Erase, a box is drawn as big as the entire chart (whatever the chart's dimensions are) and shaded in the background color. The rest of the chart is then drawn. Since the Color Graphics Printer does not "erase", this command does not work on this Printer.

Labels/Periods Prompts

Once the title, size, and chart location have been entered, the next Data Prompts display is the same for all charts except Pie Charts (since Pie Charts are circular). Even though the prompts look the same, the meaning of some of the data is different, depending on the type of chart you are building.

The data to be evaluated is:

```
SIDE LABEL
[                              ]
BOTTOM LABEL
[                              ]
PERIODS                [00001]
ITEMS/PERIOD           [00001]
SCALE LINES            [1]
```

SIDE LABEL The text you enter here is printed sideways up the left edge of the chart.
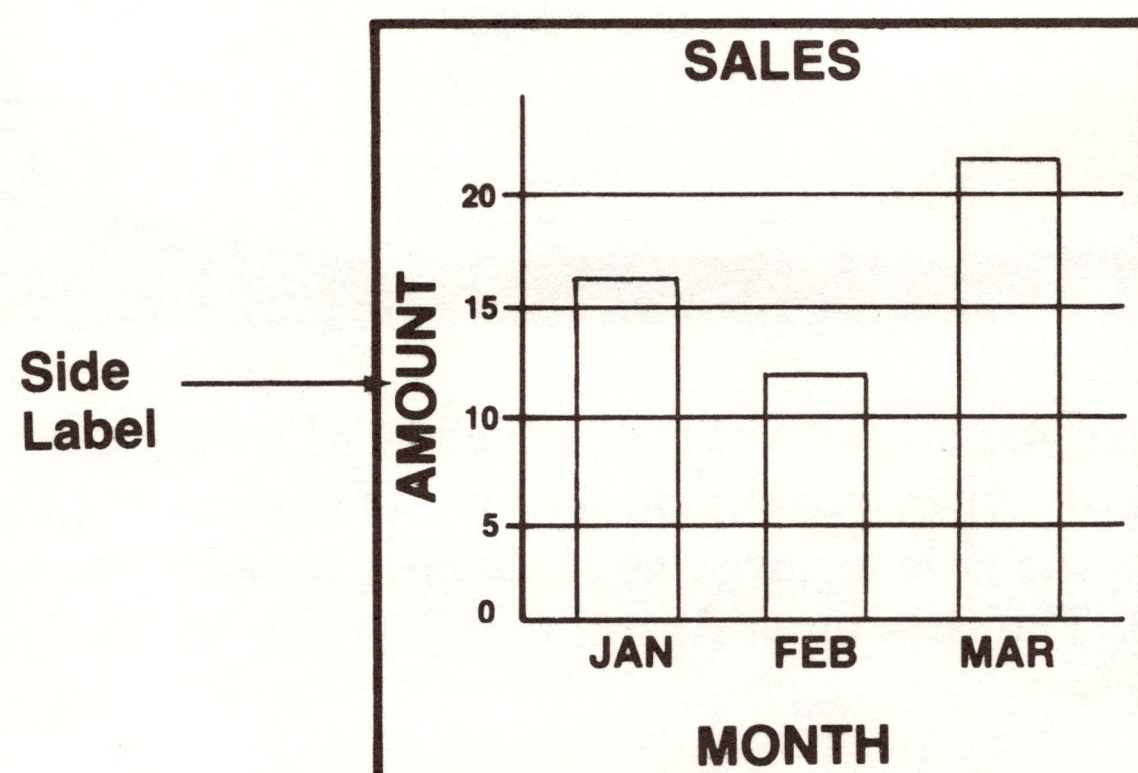

Figure 3.   Side Label on Vertical Bar Chart

The Side Label is useful in adding notes to the scale of Vertical Bar, Line, and Point Charts, but it is not usually used for Key Charts. If a Side Label is not used, there is more room available to print/display the chart. (There is no Side Label with Pie Charts.)

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BOTTOM LABEL The text you use for the Bottom Label is printed at the bottom of the chart.
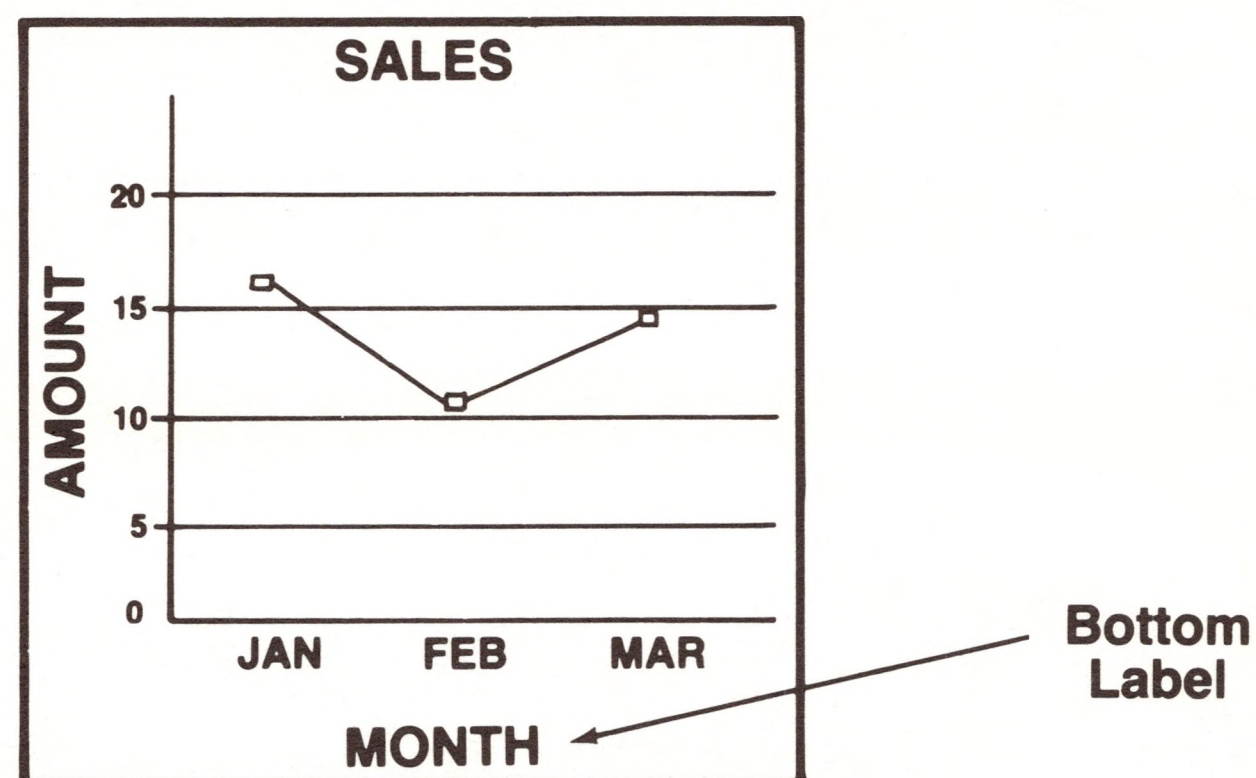
Figure 4.   Bottom Label on Line Chart

The Bottom Label is useful for adding notes to the scale of Horizontal Bar Charts and adding comments to Vertical Bar, Line and Point Charts. The Bottom Label can also be used for printing a centered line on a Key Chart. If you don't use a Bottom Label, more space is available for the chart. (Pie Charts do not use Bottom Labels.)

PERIODS Periods can be any number from 1 to 255. For Bar Charts, the number of periods is the number of groups of bars. You must enter a label for each group. For example, the periods (or groups) of bars on a Vertical Bar Chart are often labeled with a year or a day of the week. For Line Charts, periods indicate the number of points on each line. These periods are also usually labeled with a date or a year. For Key Charts, periods are the number of Key entries you want to use. For Point Charts, multiplying PERIODS and ITEMS PER PERIOD indicates the total number of points you want to plot.

ITEMS PER PERIOD Items Per Period can be any number from 1 to 255. On Bar Charts, Items Per Period indicates the number of bars in each group. On Line Charts, it indicates the number of lines to be drawn on the same chart. Items Per Period is not used for Key Charts.

SCALE LINES Disk Graphics automatically draws "Scales Lines" across Bar, Line, and Point Charts. The increments of the lines depend on the size of the chart and the chart's data. The range for Scale Lines is 0 (no lines drawn) to 1, the default (Scale Lines drawn). If you do not want Scale Lines, enter 0.

Figure 5.   Scale Lines on a Line Chart

Data Types

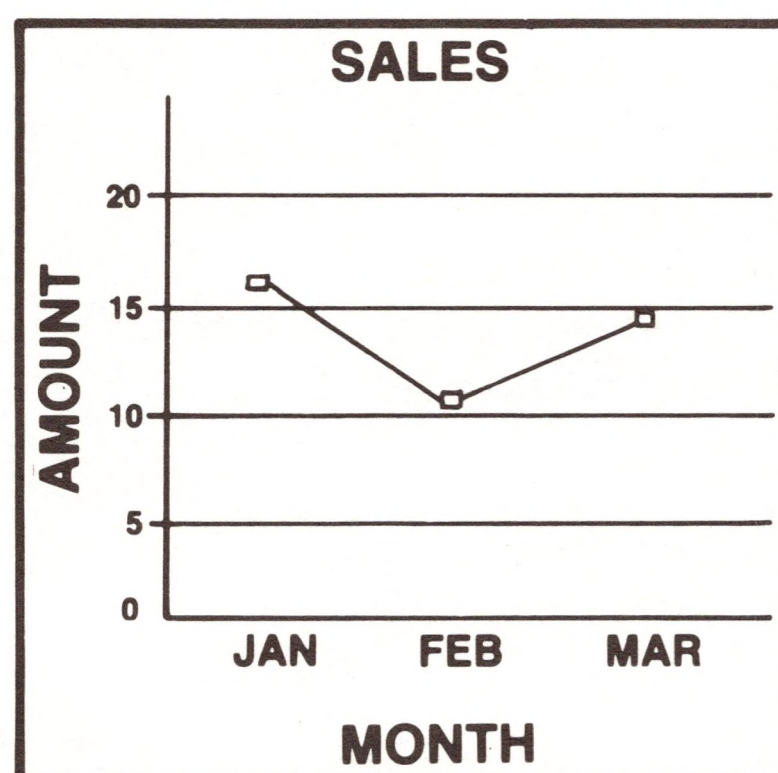There are three types of data. Each prompt requires one of these "data types":

- Text
- Single-digit Numbers
- Five-digit Numbers

Text

```
CHART TITLE:
[                                    ]
```

Text is entered between the brackets and can be either numbers or letters. Here are a few tips to help you enter text:

- Text is entered into the bracketed areas on a Data Prompt.
- If you type new text over old text, the old text is erased (and the new text appears as you type).
- ⬅ erases incorrect letters.
- If you try to type too far (beyond the bracketed area), Disk Graphics causes the Color Computer to beep to indicate an error.
- Uppercase letters are yellow on a red background; lowercase letters are red on a yellow background.
- (SHIFT)(0) locks/unlocks the keyboard in uppercase letters.

Single-Digit Numbers

```
SHADING          [0]
```

You can only enter numbers for the single-digit prompts. If you enter a letter, Disk Graphics causes the Color Computer to beep and the data is not changed. Depending on the prompt, you are limited as to how big the number can be. Disk Graphics never lets you enter an incorrect digit. For example, Color has a range from 0-3, inclusive. If you try to enter a value beyond 3, Disk Graphics will not accept the new value and will keep the old value on the Screen.

Five-Digit Numbers

```
CHART POSITION:       [00000]
```

Five-digit prompts are like single-digit prompts — you can only enter numbers. The size of the number depends on the range of that prompt (for example, the maximum range for any chart is the size of the Superscreen — 999 for the height and 999 for the width). In a few cases, 0 is not allowed (such as chart size).

The Cursor always starts at the leftmost position on the prompt:

```
          [00234]
```

Once you enter a number, the old number is replaced with the new number and the Cursor moves to the right:

```
          [00001]
```

As additional digits are entered, the number shifts to the left (just like on a calculator!):

[00015]

However, if you've entered a wrong number, press ⬅ to erase the last digit typed:

[00001]

If zero is not allowed for a prompt and you try to enter it, Disk Graphics causes the Color Computer to beep and the number remains the same. (Remember, no matter how hard you try, Disk Graphics will not let you enter a number beyond the range!)

Once the form looks the way you want it, press (ENTER) (it doesn't matter where the Cursor is currently located).

Editing

Disk Graphics has very powerful editing capabilities that let you load a chart file into memory and change some of the information in the chart definition file.

You'll use editing when you:

- are defining a chart for the first time

- want to edit a chart that's currently in memory

The editing keyboard functions are listed in Table 2.

Key/Sound	Action
▮	— Flashing rectangle signifies Disk Graphics' current position within a Data Prompt.
(↑)	— Moves Cursor up the Data Prompts.
(↓)	— Moves Cursor down the Data Prompts.
(⬅)	— Moves Cursor left and erases the last character typed.
(BREAK)	— Returns to the Main Menu (may need to be pressed repeatedly).
(ENTER)	— Enters the editing changes into memory and moves to the next menu/Data Prompts.
(BEEP)	— If you try to move the Cursor too far on a Data Prompt or try to enter the wrong information, Disk Graphics causes the Color Computer to beep to indicate an error.

Table 2.   Editing Symbols

Tips on Editing:

- **Cursor** The Cursor is placed at the bottom of each display when you edit. If you want to change an item, use (↑) to move to the item you want to change, change it, and then press (ENTER).

- **No changes** If you do not want to change anything on a display, press (ENTER) and the next display will appear.

- **Shortcut** Once you have made a change and don't want to change anything else, press (BREAK). The remaining displays will "flash by" and then the Main Menu will appear. (Exception: If you change the number of sections in a pie or the number of periods or items on Bar, Line, Key, or Point Charts to a higher number, Disk Graphics stops and waits for you to enter the additional information for these sections, periods, etc.)

Sample Session

To get you better acquainted with Disk Graphics' editor, run through a practice session (be sure to first clear features):

1. Display the Main Menu and press: ②.
2. On the REVISE PREVIOUS CHART prompt, press: ② ①.
3. From the TYPE OF CHART menu, press: ①.
4. You're now in the first series of Data Prompts for this chart. Move the Cursor down the Data Prompts with ⬇, and then up the Data Prompts with ⬆.
5. Move the Cursor to the CHART TITLE prompt and type: GROSS PROFIT MARGIN.
6. Move the Cursor to the next line with ⬇. On this line (OVERALL CHART SIZE: HEIGHT), there's a default of 191. To change this to 00000, press: ⓪. To change this line back to the default value, type: 195. Since this number is incorrect, press: ⬅ one time and then press: ①.
7. Move the Cursor back up to the chart's title and press (SPACEBAR). The chart's title is erased.
8. Turn the volume on your TV up halfway. Move the Cursor all the way up the display and then all the way down with ⬆ and ⬇, respectively. Disk Graphics causes the Color Computer to beep when the Cursor cannot proceed further.
9. Press (BREAK) three times and you're back at the Main Menu.

Superscreen

Disk Graphics has a "Superscreen" that has 999 addressable points horizontally and 999 addressable points vertically. This Screen is helpful because it lets you draw particularly wide and tall charts.

A chart can be drawn anywhere on the Superscreen (the range for a chart's height is 1 to 999 and the range for a chart's width is 1 to 999). A chart's height is on the (vertical) Y-axis and the width is on the (horizontal) X-axis.
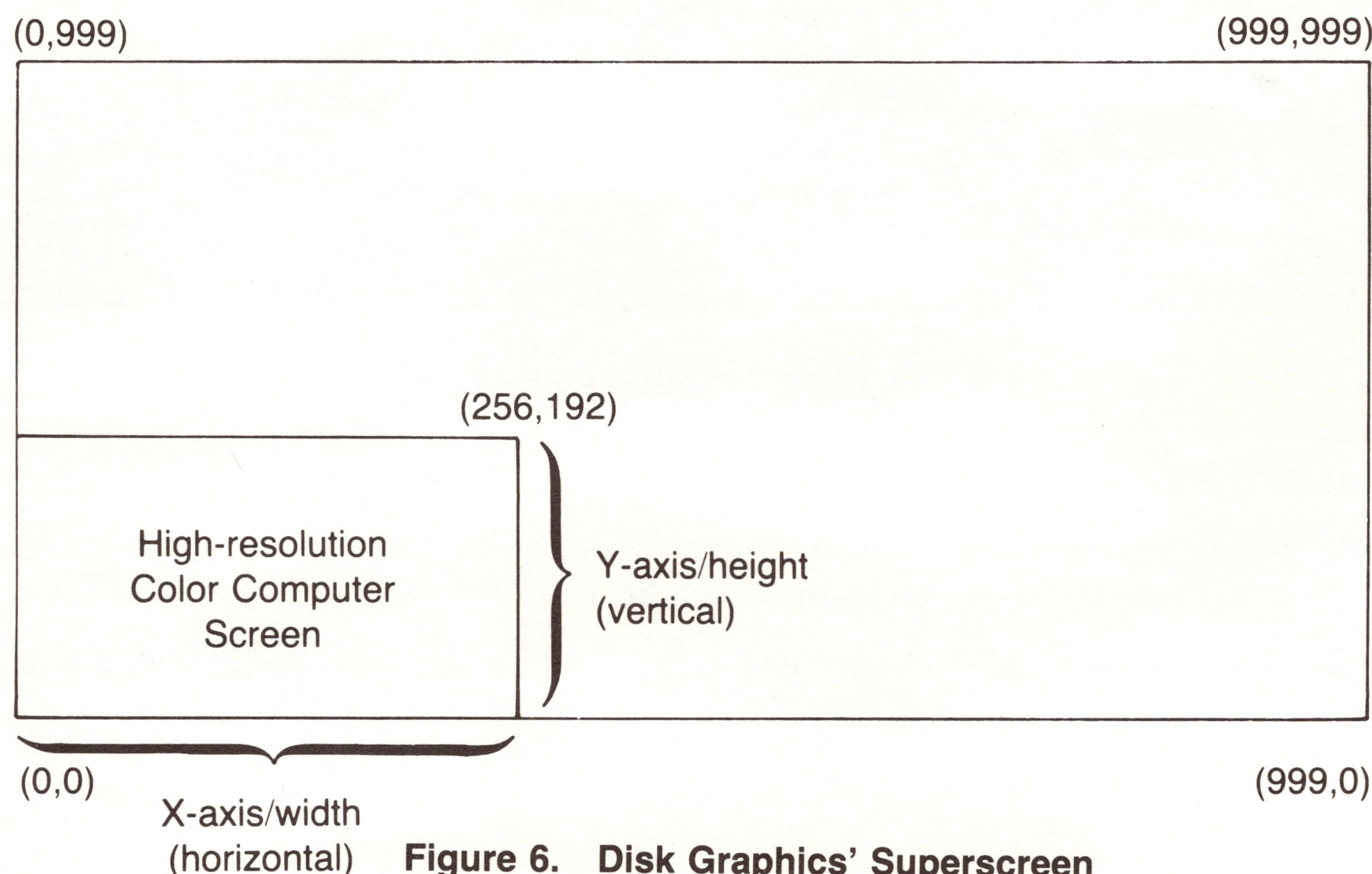
Figure 6. Disk Graphics' Superscreen

To avoid confusing these points with Color Computer Screen pixels, we'll call them "Superscreen Points".

Charts can be moved up and to the right on the Superscreen.
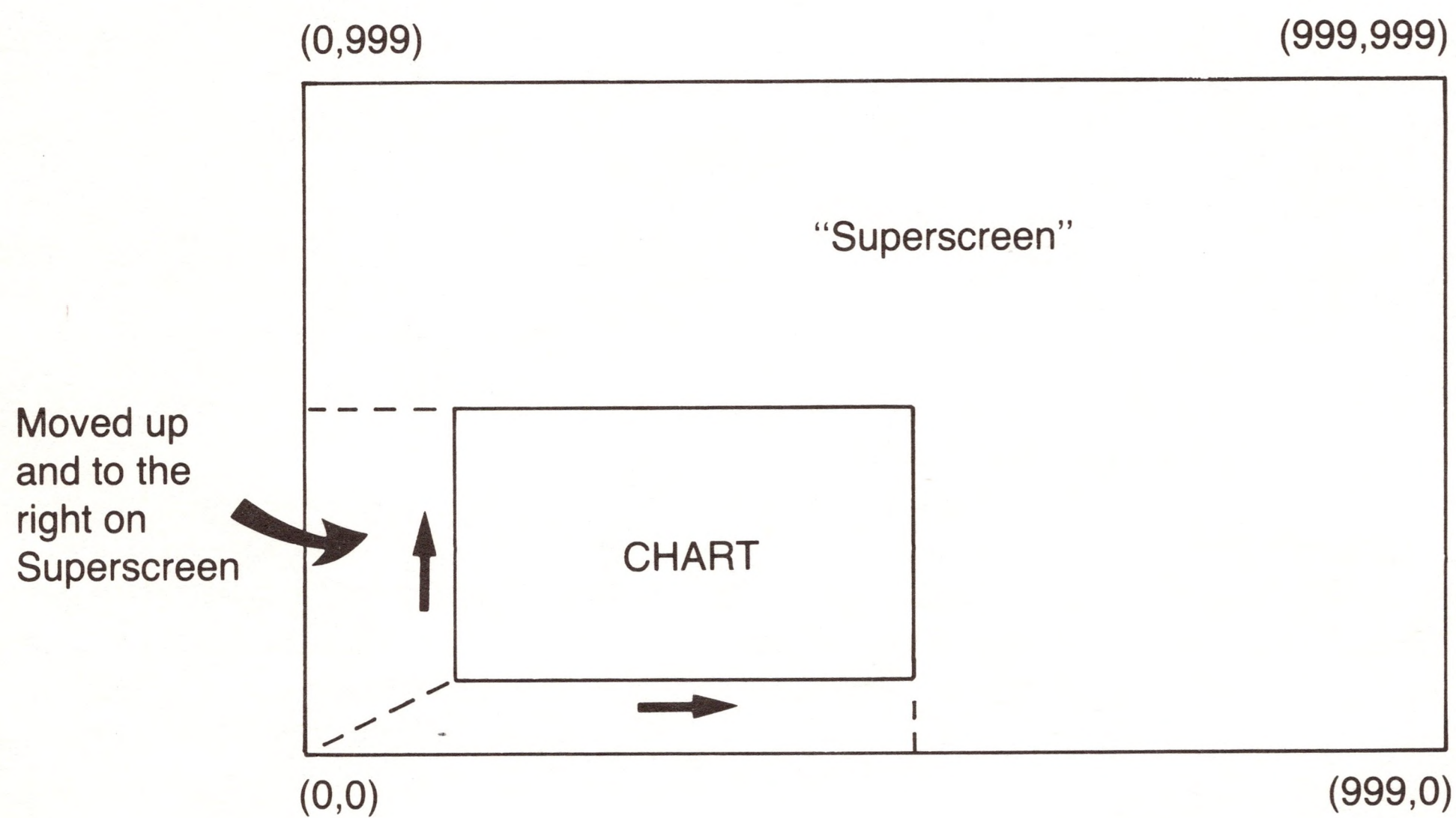
Figure 7. Moving a Chart

5/ Pie Charts

A Pie Chart compares parts to a whole and is particularly effective when you're comparing a small number of items. It is a circular "pie-shaped" chart that is divided into sections. Each "slice" of the pie represents a percentage of the "total pie". The size of each section is proportional to the percentage of the total pie represented by that section.

A pie's section descriptions are located at the right side of the chart. The descriptions have either lettering or lines identifying each section.
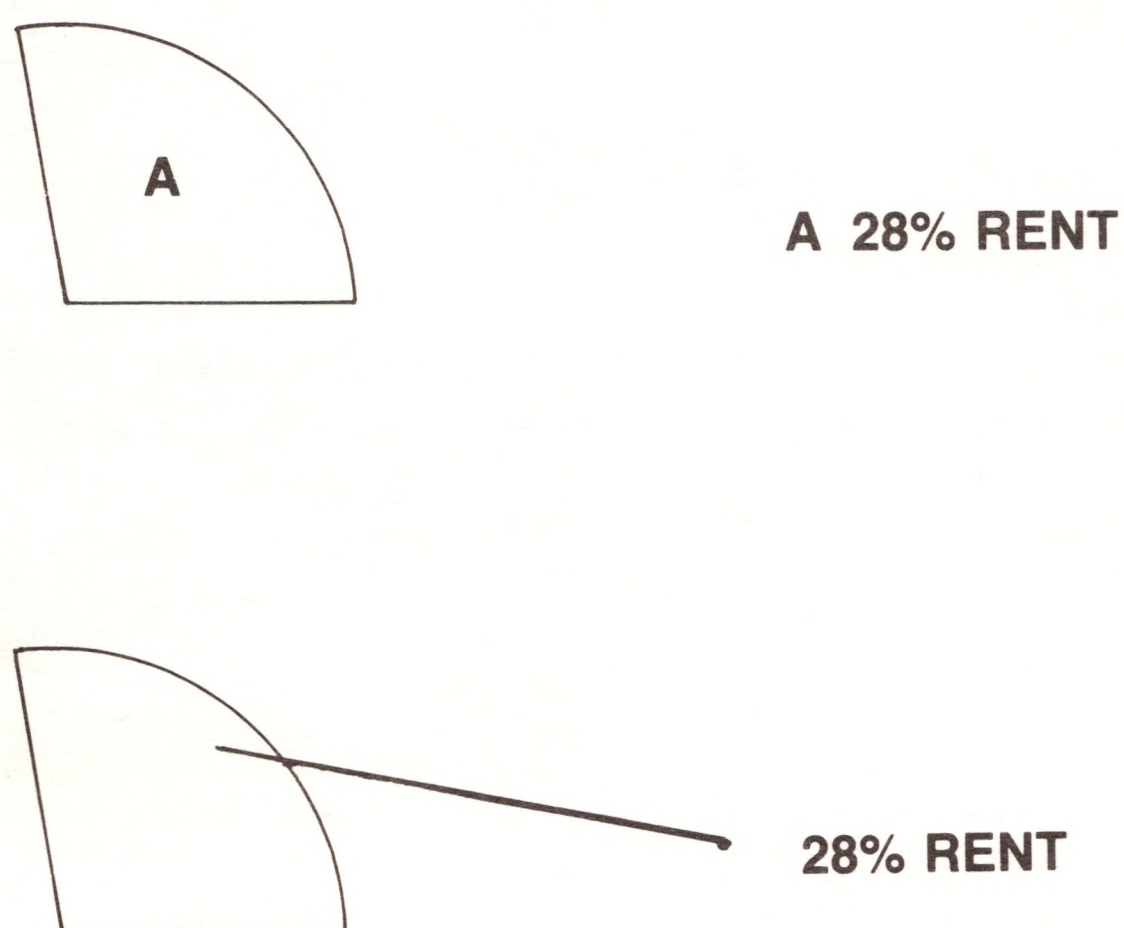
Figure 8.   Pie Section Identification

Pie sections are alphabetically lettered counterclockwise, starting with "A". The percentage descriptions of each section are listed at the right side of the chart.
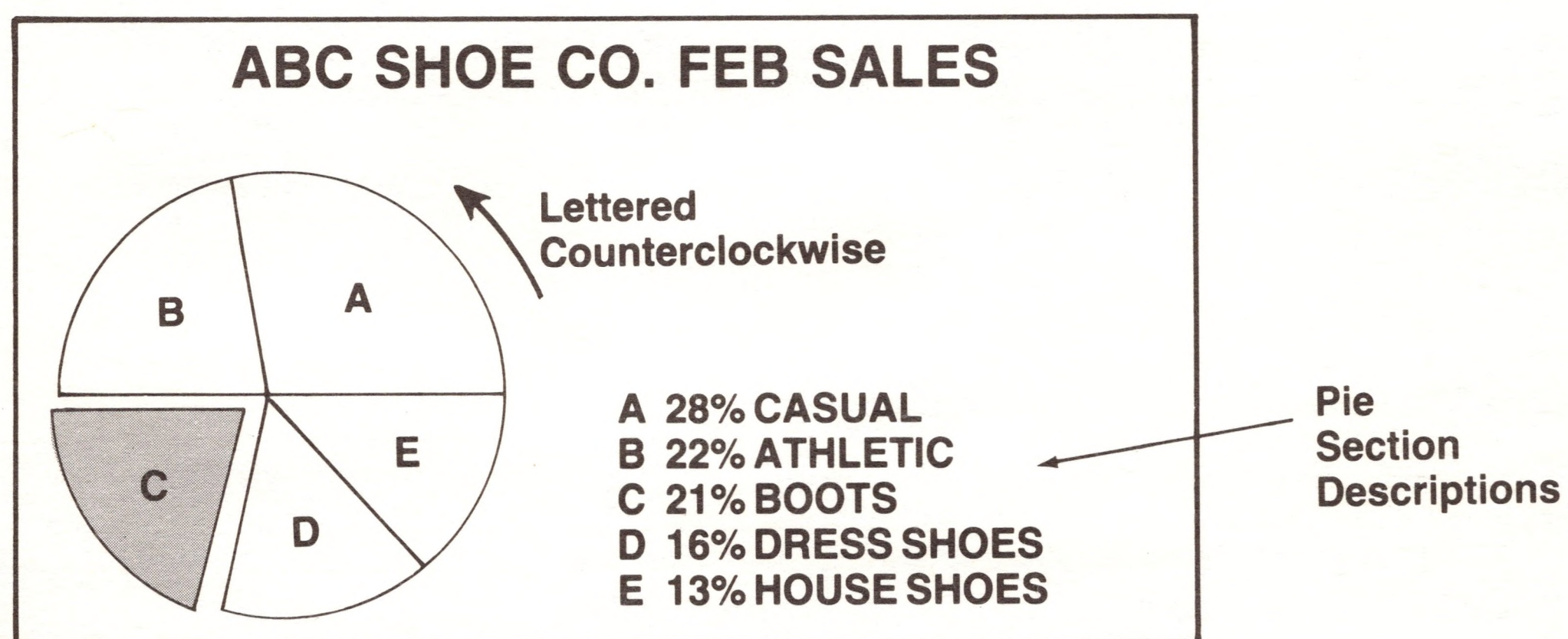
Figure 9.   Pie Chart

Every time you power-up Disk Graphics, the Main Menu is displayed. To create a Pie Chart, select Menu Selection ②(CREATE A CHART). The "Pie Chart Features" you enter (how many sections, the values for those sections, color, etc.) to the chart prompts are compiled as you proceed. The final format of the sections of the pie are determined by the values you enter in the chart definition.

Sample Session

Draw a Pie Chart for a monthly budget. These are the expenses:

rent	$250
food	$138
car upkeep	$206
miscellaneous	$177
entertainment	$ 80
$851	total

As with any budget, you'd like to know how much (percentage-wise) you are spending a month for these items. A Pie Chart, which displays sections and percentages, is a perfect way to find out.

Clear features and then answer the prompts to draw a Pie Chart for this budget:

1. Display the Main Menu and press: ②.

2. On the REVISE PREVIOUS CHART prompt, press: ② ①.

3. From the TYPE OF CHART menu, press: ①.

4. For the CHART TITLE prompt, type: BUDGET (ENTER).

5. There are five sections or "slices" (rent, food, car upkeep, miscellaneous, and entertainment), so for the NUMBER OF SLICES prompt, type: ⑤ (ENTER).

6. Now you are ready to enter the values for each section. The first PIE SLICE SIZE prompt is for Pie Section (slice) number 1, rent. Type: 250. Move the Cursor down to DESCRIPTION and type: RENT (ENTER).

7. A new set of PIE SLICE SIZE prompts is now displayed. This second set of prompts is for Pie Section 2, food, so type: 138. Move the Cursor down to DESCRIPTION and type: FOOD (ENTER).

8. This next set of prompts is for Pie Section 3, car upkeep, so type: 206. Move the Cursor down to DESCRIPTION and type: CAR UPKEEP (ENTER).

9. The fourth set of PIE SLICE SIZE prompts is for Pie Section 4, miscellaneous expenses.

   - Type: 177.

   - Move the Cursor to SHADING EXCEPTION and type: 1.

   - Move the Cursor to OFFSET and type: 12.

   - Move the Cursor to DESCRIPTION and type: MISCELLANEOUS (ENTER).

10. The last set of prompts is for Pie Section 5, entertainment, so type: 80. Move the Cursor down to DESCRIPTION and type: ENTERTAINMENT (ENTER).

After entering this last value, you are back at the Main Menu. Press: ⑥ (DISPLAY RESULTS). From the next menu (DISPLAY METHOD?), press: ②. On the next prompts, press (ENTER).

The chart is drawn on the Screen in high resolution. Pie section D, representing miscellaneous expenses, is offset from the other sections and shaded in black. The pie sections have alphabetical numbering:

- Rent (section A) is 29% of the total monthly budget.

- Food (section B) is 16% of the total.

- Car upkeep (section C) is 24% of the total.

- Miscellaneous (section D) is 21% of the total.

- Entertainment (section E) is 9% of the total.

The total percentage of this example ($29 + 16 + 24 + 21 + 9$) is 99%, rather than 100%. Disk Graphics *always* rounds off percentages to the nearest integer, so the percentage total for many pie charts is 99%. For example, these are the percentages to two significant digits for your budget program:

rent	29.38%	(rounded to 29%)
food	16.22%	(rounded to 16%)
car upkeep	24.21%	(rounded to 24%)
miscellaneous	20.80%	(rounded to 21%)
entertainment	9.40%	(rounded to 9%)
total	100.01%	(total of rounded values is 99%)

Resolution

Display this Pie Chart now in low resolution (96 x 128). (First, press **BREAK** to return to the Main Menu.)

1. From the Main Menu, press: **6**.

2. For a four-color low-resolution Screen, press: **1**.

3. On the next set of prompts, press **ENTER** and the pie chart is displayed. Note that Pie Section D is now shaded in red. Since you're in low resolution, you can only see the lower-left corner of the Pie Chart.

To display the entire Pie Chart in low resolution, you'll have to reduce the size of the chart (Image Size Reductions). To do this:

1. Press **BREAK** and you're back at the Main Menu.

2. Press: **6**.

3. From the display menu, press: **1**.

4. Press **↑** twice and type: **1** **ENTER**. The four-color display now fits perfectly on the Screen — however, with less resolution. Note that the high-resolution text may not be readable in this lower-resolution mode. This mode is primarily used for color selection.

5. Press **BREAK** to return to the Main Menu.

Note: If you want to view your chart in low resolution, you can define your chart as being 95 high by 127 wide. (You may need to shorten some descriptions.) If you reduce the dimensions of the chart in the chart definition, you will not need to use Image Size Reductions. The chart will just fit on the Screen, and the images will be much clearer than they would be if you used the Image Size Reductions feature of Disk Graphics.

Important Prompts

Look at some of the important prompts in the Pie Chart program. After you enter the chart title, you will see prompts for three items:

```
NUMBER OF SLICES                    [00001]
PERCENT (0=NO,1=YES)      [1]
REF. (0=LINES,1=LABELS) [1]
```
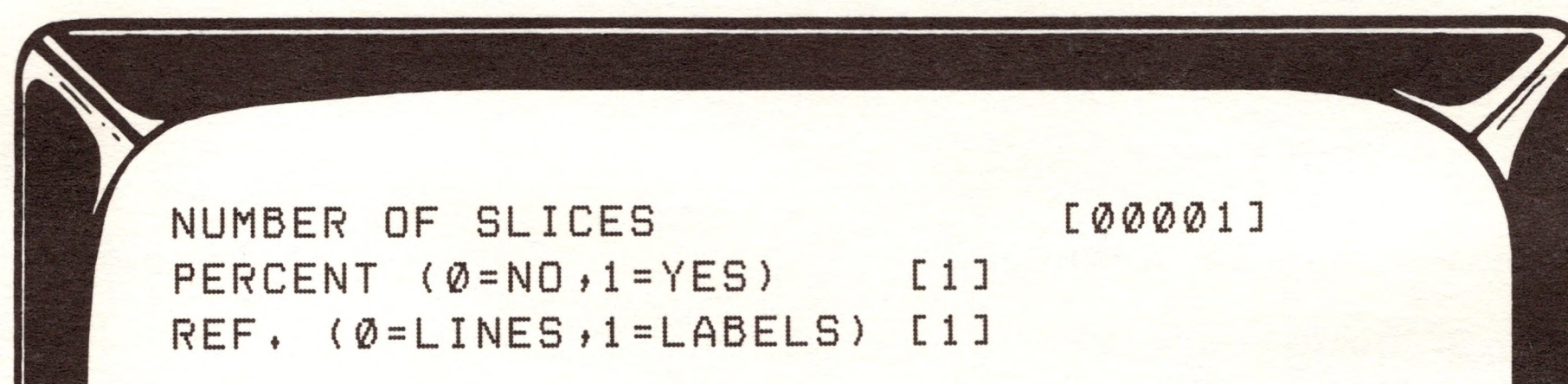
NUMBER OF SLICES You have to enter a number and description for each section. The maximum number of sections allowed is 255, but the physical maximum depends on how big you make your chart (smaller charts have less space for describing multiple sections). Disk Graphics is extremely accurate — it can draw pie sections to an accuracy of one degree!

You can enter over 80 sections on a chart that is 999 points high, but that would look extremely congested. You'll find that Pie Charts look well-spaced and uncluttered when you have 8 or less sections. More than 26 slices is not recommended since special characters will be generated as reference letters.

PERCENT There are two choices for percentages — yes or no (1 or 0, respectively). By entering yes (the default), Disk Graphics calculates the percentage of the total pie that each section represents and displays it as a part of the section's description:

<p style="text-align:center">28% RENT</p>

Percentage is accurate to 1 percent and is rounded. If you do not want percentages shown, change the percent to 0:

<p style="text-align:center">RENT</p>

REFERENCE Reference prints a letter in the middle of each pie section and to the left of the section's description:
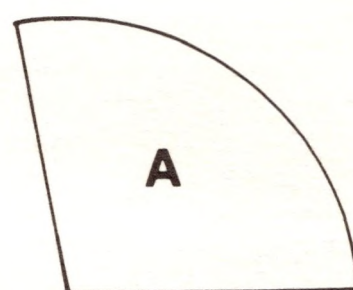
Reference can be either 0 or 1 (1 is the default). If reference is 0, a line is drawn from each section's description to the pie section described:
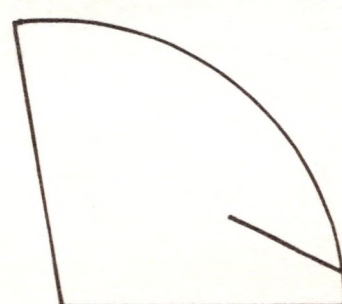
The next Data Prompts are these:

```
PIE SLICE
SIZE:                        [00001]
COLOR                        [0]
SHADING EXCEPTION            [0]
OFFSET                       [00000]
DESCRIPTION
[                                    ]
```

SIZE This is the value (and thus the "size") you want each pie section (slice) to be. The range is 1 to 30,000. You can enter any whole number and the number is converted to a percentage of the pie by Disk Graphics. In the Pie Chart for the monthly Budget, 250 is converted to 29% RENT (depending on the totals of the entire pie). If you already know the percentages or degrees, you can enter them as long as the total of all sections is 100 percent or 360 degrees.

COLOR The range for Color is 0 to 3. You'll have to decide how you're going to display your Pie Chart before you enter the value for Color because different "displayers" (high- or low-resolution Screen and printers) have different color sets (see Chapter 2, **Program Overview**). Since dot-matrix printers are black-and-white, Color works as "shading." All four colors are visible on the Color Graphics Printer but only three are visible on the Color Computer Screen (all but the background color).

SHADING EXCEPTION Shading Exception determines if a particular pie section is shaded and is either 0 or 1. Shading Exception "takes exception to" the Shading for the total pie:

Shading	Shading Exception	Action on Pie Section
0	0	no shading
0	1	shading
1	0	shading
1	1	no shading

Table 3.   Shading/Shading Exception

Normally all sections are shown only as an "outline", but with shading, the section is filled in with the specified color.
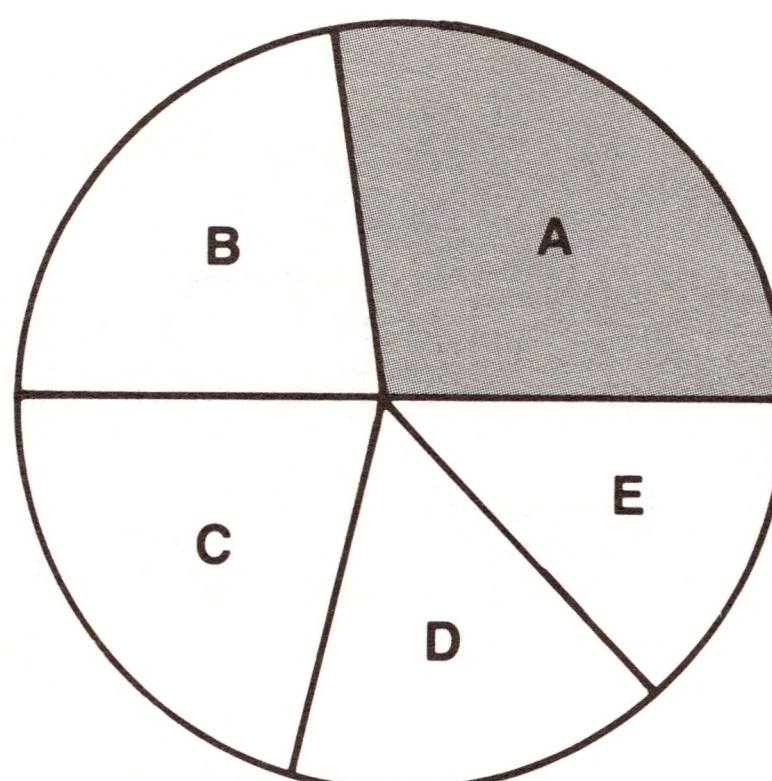
Figure 10.   Shading

OFFSET This variable tells how many Superscreen Points from the center of the pie to set off (or "offset") the pie section. Each section can be moved up to 250 points away from the center (0 is not offset). You'll want to use Offset when you want a predominant section to stand out from the others.
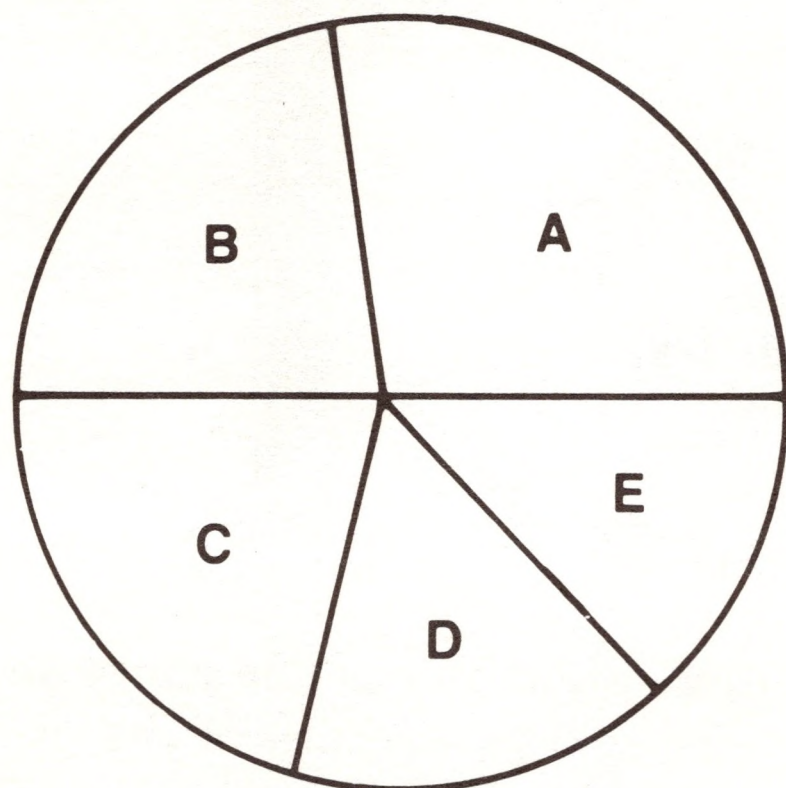
Figure 11.   No Offset Sections
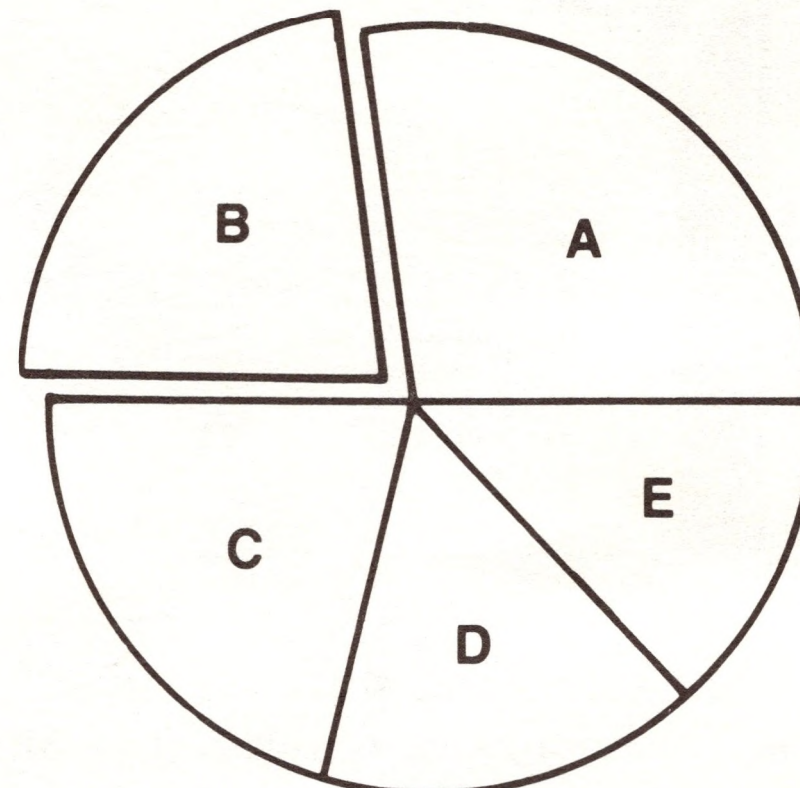
Figure 12.   One Offset Section

DESCRIPTION This is the name of each section. Be as brief as possible. Descriptions will be as large as possible as long as they do not use more than 1/2 the width of the chart. Three- or four-letter abbreviations (FRI, JAN, AUTO, etc.) are a good length. Descriptions are displayed to the right of the Pie Chart.

The starting location for printing these labels is a point 3/4 of the radius outward from the center of the circle along a line that bisects the arc of the slice. This locus represents the lower-left corner of the dot matrix of the description's first letter. As a result, the label is generally upward and to the right of that point.

The program keeps track of the smallest slice size. If a slice is less than 32 degrees, a text size 1/2 as large as normal is used for the labels.

A Pie Chart's diameter depends on how much height is available below the title, the width of the chart, and the longest section description.
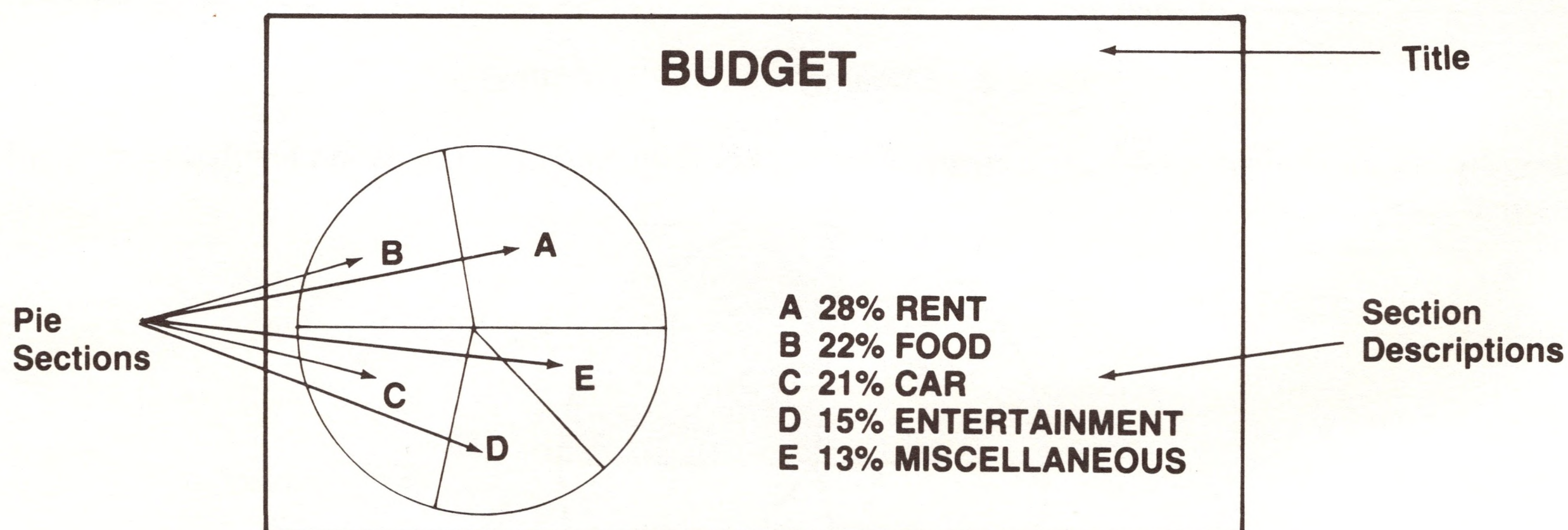
Figure 13.   Locations on Pie Chart

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Self-Check

After you have entered all the data for each section, Disk Graphics does a "self-check" (without displaying the chart on the Screen) to see if all the data will fit on the chart so a chart can be drawn. (It is attempting to generate features.) If a chart can be drawn, you will be returned to the Main Menu after the self-check. If there's a problem, the Screen is cleared, the error number is displayed and a one- or two-line description of the error is shown. For an easy solution, refer to Appendix A, **Graphic Error Messages**.

6/ Bar Charts

In this chapter we'll discuss the two types of bar charts:

- Vertical

- Horizontal
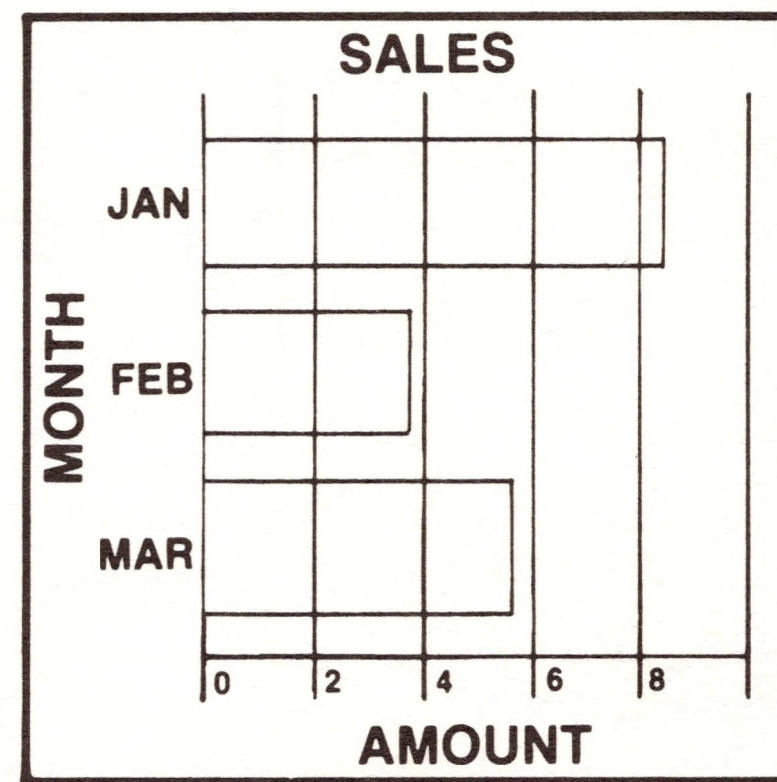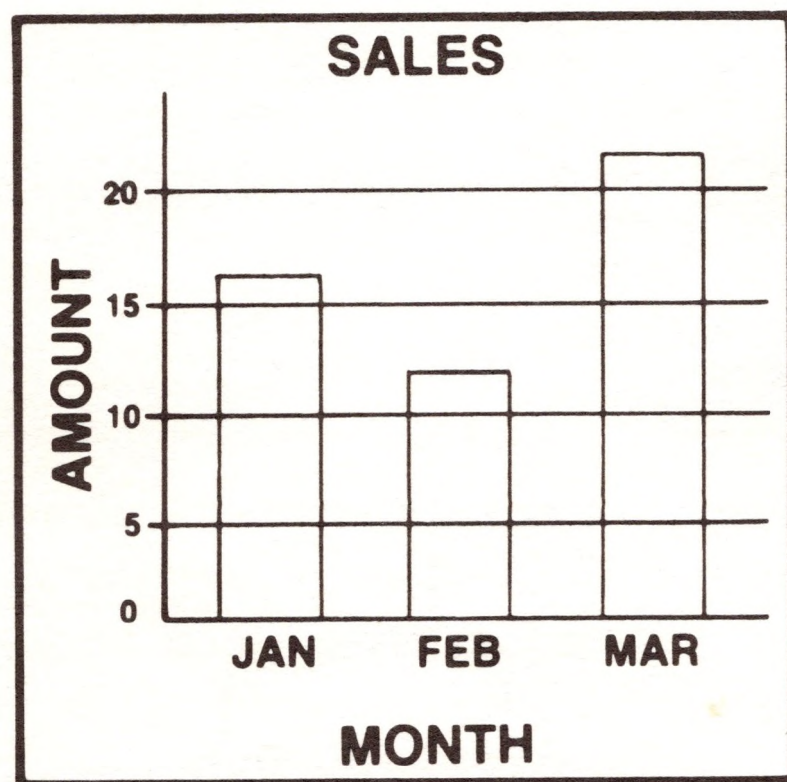
Figure 14.   Vertical Chart   Horizontal Chart

Both types of charts may have either one item of data per period or multiple items of data per period.
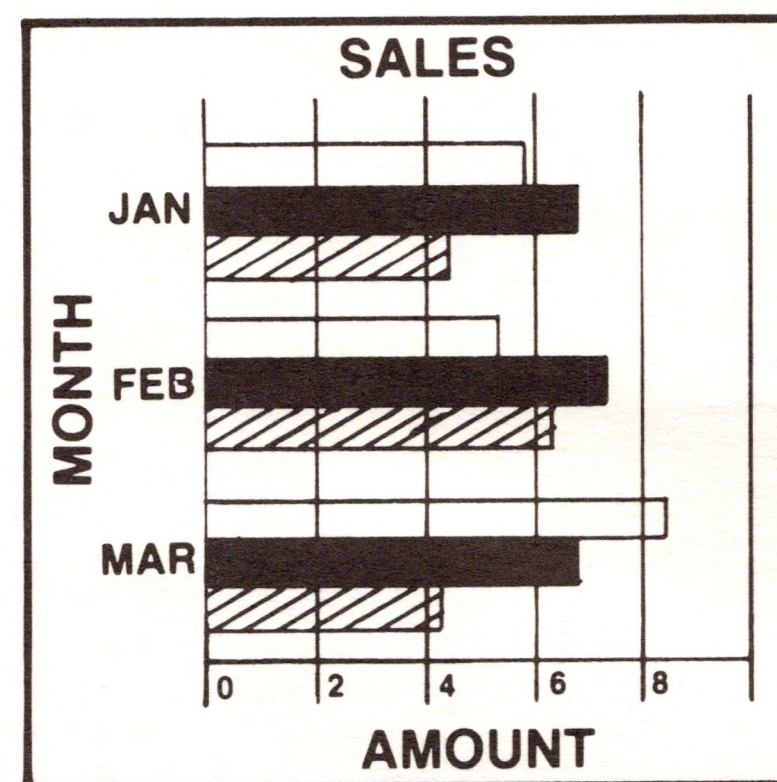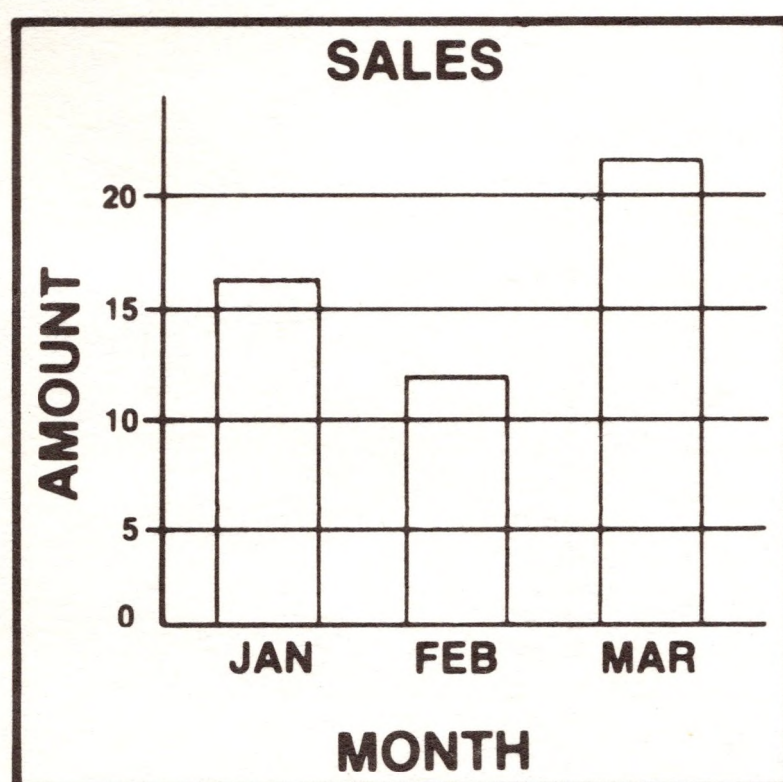
Figure 15.   One-Group Vert. Chart   Three-Group Hor. Chart

Both types of bar charts have the same principle, except:

- **Titles reversed** The bars in a Vertical Bar Chart are drawn from top to bottom (vertically) while the bars in a Horizontal Bar Chart are drawn left to right (horizontally). Consequently, the titles on the side and bottom of the charts are reversed.

- **Title size** You can use longer titles on the side of a Horizontal Bar Chart because the titles are displayed horizontally (not "end-to-end" like on Vertical Bar Charts). The longer the titles, the more compressed the bars are; the shorter the titles, the more elongated the bars are. You might want to use a Vertical Bar Chart when your titles are very brief and you don't need the extra room as when you're using years (80, 81, etc.) or numbers (1, 2, etc.).
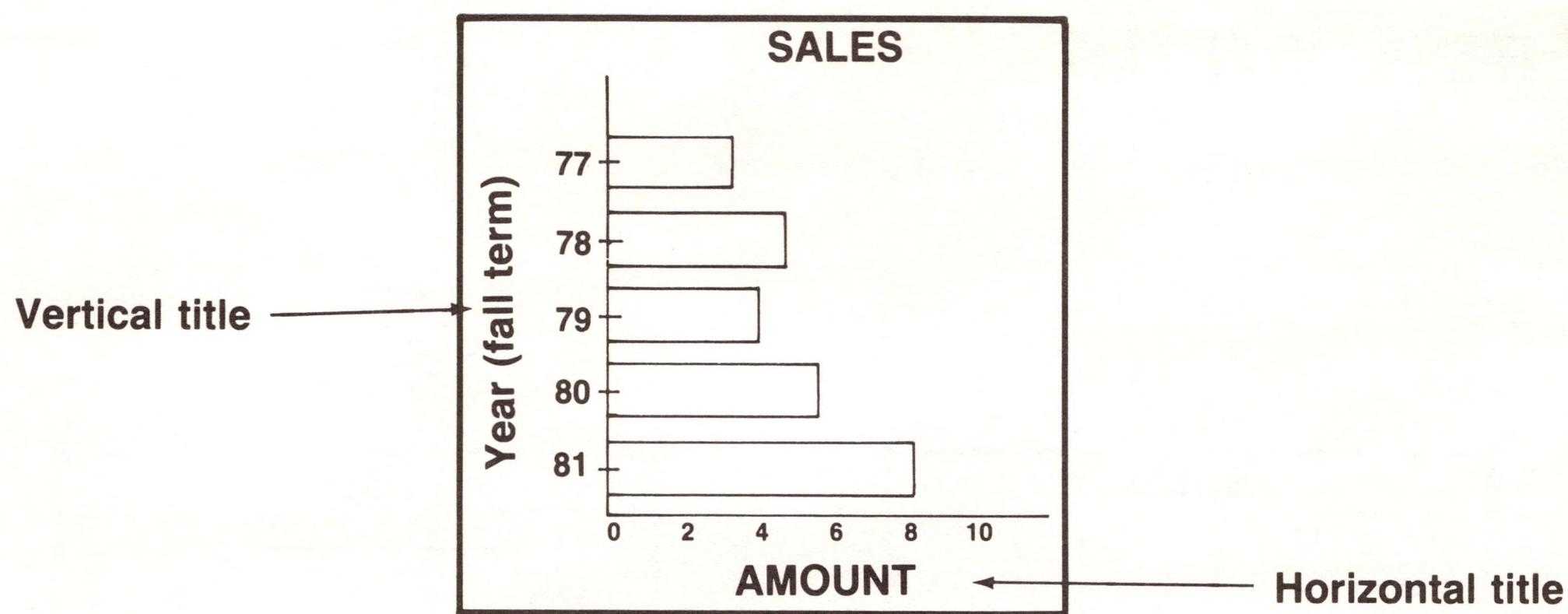
Figure 16.   Titles

Bar charts point out individual values and are effective for item-to-item comparisons. The size of each data value is indicated by the length of the bar, measured against the vertical or horizontal scale. Bar charts can also show variance — such as plan versus performance, or this year's sales versus last year's. Bar charts are helpful to use when you want to easily see the differentiation of the values that compose the bars. The thick bars (as opposed to points in a Line Chart) help the data really stand out, especially if you use shading as a "highlighter" for one or more of the bars.

Look at some of the bar prompts:

VALUE Value can be any number from 1 to 30,000. The values on a chart determine how wide or tall the bar will be.
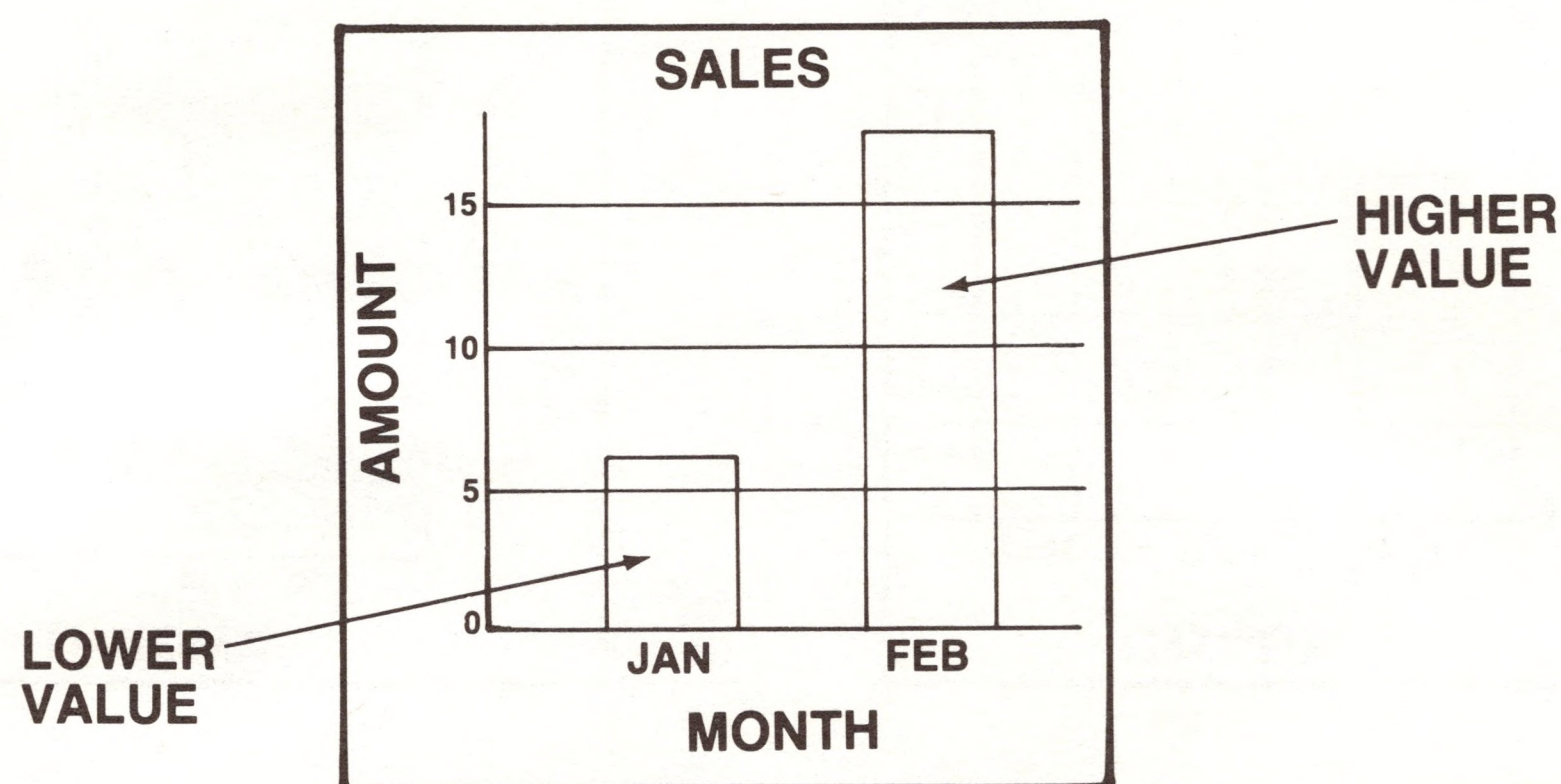
Figure 17.   Values

Bars are automatically scaled by Disk Graphics so that the largest value entered is as tall and wide as physically possible.

COLOR Disk Graphics automatically assigns different colors to the bars within each multi-bar group, but you can assign the colors yourself.

SHADING EXCEPTION Disk Graphics prints/displays alternating shaded and unshaded bars in a group; however, you can "override" this using Shading Exception.

One-Group Vertical Bar Charts

Plot a one-group Vertical Bar Chart for the fall enrollment of State University over a seven-year period (1976-1982). Because of a 25% tuition increase for the fall term of 1979, enrollment for that session dropped drastically — below 20,000.

These are the enrollment figures:

22,066	1976
22,651	1977
21,573	1978
19,879	1979
22,326	1980
23,780	1981
25,022	1982

To draw the chart:

1. First, clear features.

2. Display the Main Menu and press: ② ② ①.

3. For the TYPE OF CHART prompts, press: ②.

4. Type the Chart Title in uppercase letters: STATE U. ENROLLMENT. Press ENTER.

5. Enter the labels in lowercase letters. For the Side Label, type: NUMBER OF STUDENTS; for the Bottom Label, type: YEAR (FALL TERM). Since there are seven years, for the periods (the number of bars in the chart) press: ⑦ ENTER.

6. Next comes the name for each bar (period). The first bar is the first year of our chart (1976).

   - For the name of period 1, type: 76 ENTER.
   - For period 2, type: 77 ENTER.
   - For period 3, type: 78 ENTER.
   - For period 4, type: 79 ENTER.
   - For period 5, type: 80 ENTER.
   - For period 6, type: 81 ENTER.
   - For period 7, type: 82 ENTER.

7. Next comes the value for each bar (the number of students enrolled in each fall term).

   - For the value of period 1, type: 22066 ENTER.
   - For period 2, type: 22651 ENTER.
   - For period 3, type: 21573 ENTER.
   - For period 4, type: 19879. Since this was a particularly bad year for enrollment, shade this bar so it stands out. Move the Cursor down to Shading Exception and press: ① ENTER.
   - For period 5, type: 22326 ENTER.
   - For period 6, type: 23780 ENTER.
   - For period 7, type: 25022 ENTER and you're back at the Main Menu.

Now display the results on your Screen in high resolution. The bar for 1979 is shaded in black.

Multi-Group Vertical Bar Chart

To see an example of a multi-group chart, plot the monthly profit increases over last year for three companies owned by Acme Inc. The figures are:

	Retail Div.	Steel Div.	Plastics Div.
Jan	11	9	7
Feb	15	13	18
Mar	4	2	8

There are three periods in this chart (Jan, Feb, and Mar) and three items in each period (retail div., steel div., and plastics div.). Enter the values for this chart:

1. First, clear features.

2. Display the Main Menu and press: ②②①.

3. For the TYPE OF CHART prompts, press: ②.

4. Type the title of the chart in uppercase letters: ACME INC. MONTHLY PROFITS. Press (ENTER).

5. Enter the labels in lowercase letters. For the Side Label, type: PERCENTAGE INCREASE; for the Bottom Label, type: MONTH.

6. Since there are three months, for the periods type: 3.

7. For the ITEMS/PERIOD prompt, type: 3 (ENTER).

8. Next comes the name for each bar (period).

   Name of period 1: JAN.

   Name of period 2: FEB.

   Name of period 3: MAR.

9. Now comes the value of each item in each period.

   Value for period 1, item 1: 11.

   Value for period 1, item 2: 9.

   Value for period 1, item 3: 7.

   Value for period 2, item 1: 15.

   Value for period 2, item 2: 13.

   Value for period 2, item 3: 18.

   Value for period 3, item 1: 4.

   Value for period 3, item 2: 2.

   Value for period 3, item 3: 8.

Now display the results on the high-resolution Screen. You'll notice that Disk Graphics has assigned a different color to each bar and automatically alternated the shading.

Note: A Key Chart can be added later to distinguish one division from another (see Chapter 8).

Horizontal Bar Charts

The Side and Bottom Labels on a Horizontal Bar Chart are "reversed" when compared to a Vertical Bar Chart.

For an example of a Horizontal Bar Chart, chart the trading price of one ounce of silver over a one-week period. We'll assume for the following fictitious prices that there was a great deal of speculation by buyers during the week and the price fluctuated wildly.

Here are the opening trading prices for each day:

Monday	$34.50
Tuesday	$39.50
Wednesday	$46.47
Thursday	$34.18
Friday	$29.56

To plot the chart, follow these steps:

1. First, clear features.

2. Display the Main Menu and press: ② ② ①.

3. From the TYPE OF CHART menu, press: ③.

4. Enter the values in the same way as you entered them for a Vertical Bar Chart. Name the chart in uppercase letters: SILVER TRADING PRICE. Name the labels in lowercase letters. For the Side Label, type: DAY OF WEEK; for the Bottom Label, type: PENNIES PER OUNCE.

5. There are five periods (five days in a week), so for PERIODS, press: ⑤ ENTER.

6. Now, name each bar. You can enter the full name of each day of the week.

   - Monday

   - Tuesday

   - Wednesday

   - Thursday

   - Friday

7. Next enter the value for each bar. (Note: When using decimal point values, such as percentages, monetary values, etc., you'll have to enter the values without decimal points. For instance, $34.50 is entered as 3450.)

   - 3450 for Monday

   - 3950 for Tuesday

   - 4647 for Wednesday — Since Wednesday's opening price was exceptionally high, shade this bar (for Shading Exception, enter: ①).

   - 3418 for Thursday

   - 2956 for Friday

8. Display the chart in high resolution on your Screen. When displayed, you'll see the Bottom Label (`PENNIES PER OUNCE`) has increments of 2000 and 4000. Since we can't enter decimals (the dollar amount), these increments represent how many pennies (rather than dollars) the silver costs per ounce.

> **Note:** Edit Features can be used to insert decimal points.

Display the chart now in low resolution. In addition to the background color, green, you'll have three other colors to work with: yellow, blue, and red.

Do some editing to take advantage of these colors:

1. Return to the Main Menu and press: ②.

2. From the `REVISE PREVIOUS CHART?` prompt, press: ①.

3. Now you're back into the Horizontal Bar Chart (`SILVER TRADING PRICE`) which you just created. Change Shading to ①. Press (ENTER) eight times.

4. You're now in Period 2. Move the Cursor up to Color and press: ② (ENTER).

5. For Period 3, change Shading Exception back to ⓪. Then move the Cursor up to Color and press: ① (ENTER) (ENTER).

6. For Period 5, move the Cursor up to Color and press: ③ (ENTER). You're now back at the Main Menu.

7. Press: ⑥ to display results. For low resolution, press: ①. To reduce the image, move the Cursor to `IMAGE SIZE REDUCTIONS` and press: ① (ENTER).

The Horizontal Bar Chart is drawn on the Screen. Bar 1 (Monday) is shaded in red, bar 2 (Tuesday) is shaded in yellow, bar 3 (Wednesday) is shaded in blue, bar 4 (Thursday) is shaded in red, and bar 5 (Friday) is "invisible" because it is shaded in the background color, green.

Display the chart (with the current shading) in high resolution:

1. Return to the Main Menu and press: ⑥.

2. From the Display Menu, press: ② (ENTER). The chart is displayed. Bar 1 is shaded in black, bar 2 is shaded in light gray, bar 3 is shaded in dark gray, bar 4 is shaded in black, and bar 5 is shaded in the background color again, green.

3. Press (BREAK) to return to the Main Menu.

7/ Line Charts

A Line Chart shows how data changes over time, and illustrates the continuous flow of change. The emphasis is on trends over a series of days, months, or years. Each time period on the Chart's horizontal scale is associated with a data point whose value is measured on the vertical scale. A Line Chart is a graph of points (values) connected by a line. With Disk Graphics, you can draw either single- or multi-line (used for easy comparison) charts.
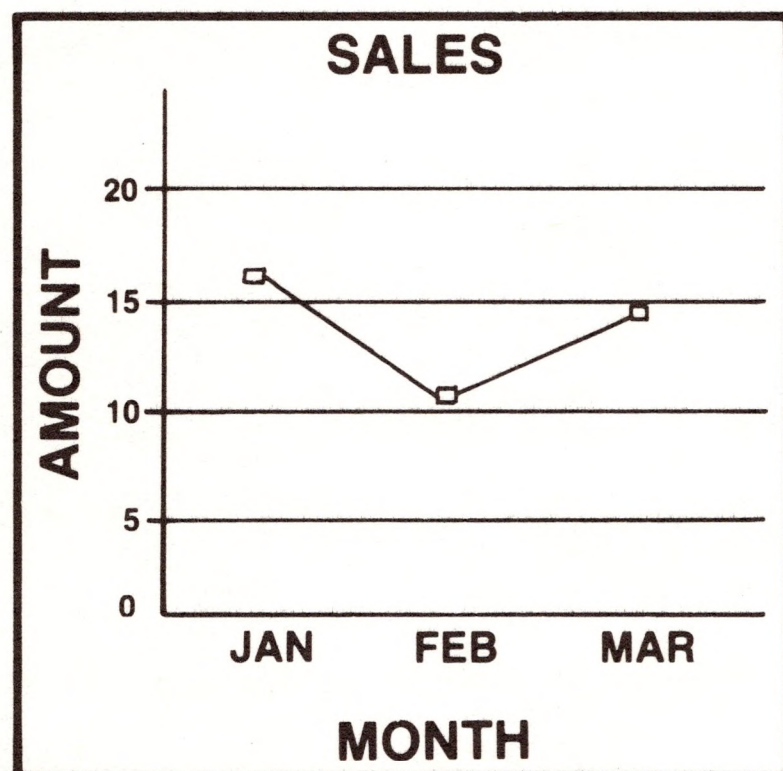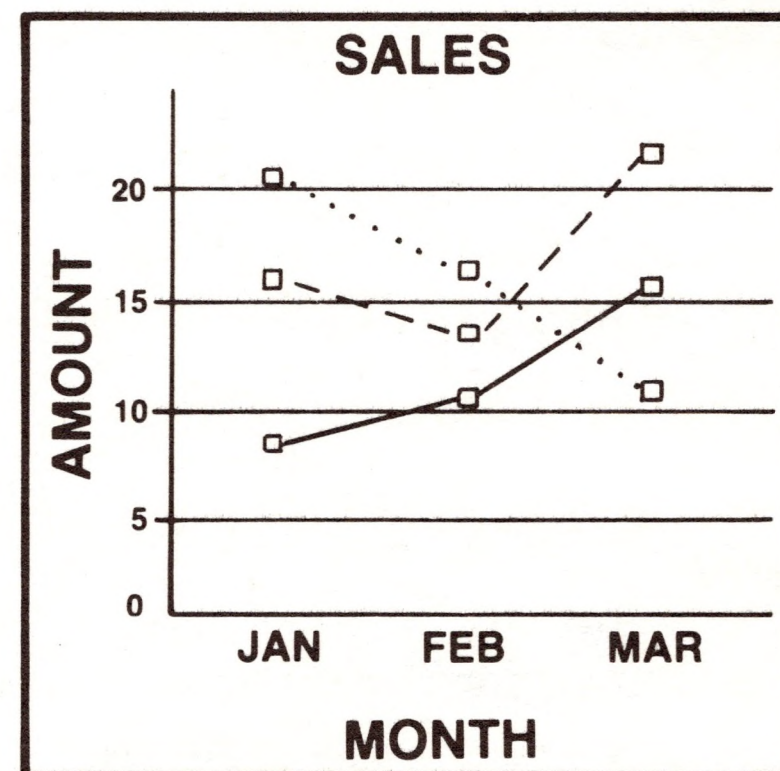
Single-Line Charts   Multi-Line Charts

Figure 18.   Line Charts

All lines in a Line Chart have a point in the first period, followed by a line that connects a point in the next period to the first period point, followed by a line that connects a point in the next period to the second period point, etc.
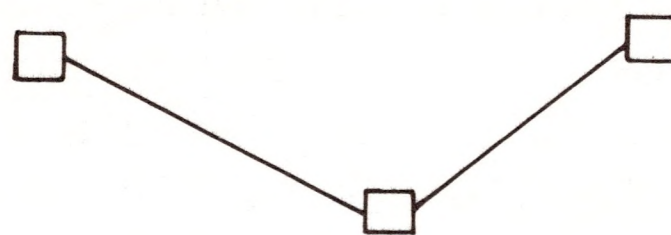
Figure 19.   Large Points

Single-Line Chart

Plot the daily high temperature over a one-week period in St. Louis.

These are the temperatures:

Monday	63
Tuesday	50
Wednesday	39
Thursday	33
Friday	44
Saturday	59
Sunday	55

Enter these for the prompts:

```
          CHART TITLE:                DAILY HIGH TEMPERATURE
          SIDE LABEL:                 TEMPERATURE
          BOTTOM LABEL:               DAY
          PERIODS:                    7
          NAME OF PERIOD     00001:   MON
          NAME OF PERIOD     00002:   TUE
          NAME OF PERIOD     00003:   WED
          NAME OF PERIOD     00004:   THU
          NAME OF PERIOD     00005:   FRI
          NAME OF PERIOD     00006:   SAT
          NAME OF PERIOD     00007:   SUN

          POINTS:
                   COLOR:             0
                   SIZE:              2

          VALUE FOR  PERIOD  00001:   63
          VALUE FOR  PERIOD  00002:   50
          VALUE FOR  PERIOD  00003:   39
          VALUE FOR  PERIOD  00004:   33
          VALUE FOR  PERIOD  00005:   44
          VALUE FOR  PERIOD  00006:   59
          VALUE FOR  PERIOD  00007:   55
```

Display the results in high resolution. Since you used "2" for the size of each point, the seven points on the line are displayed as small boxes. Try changing the size to "6" (the boxes are now much larger!). Change the size to the maximum: 9.

Note: On the display that asks for the value of each point on the line, two prompts (MAXIMUM and MINIMUM) appear with a default value of zero. Enter nothing in these items for a simple Line Chart.

If you enter values in these items, a vertical line will be drawn through the point from the maximum value to the minimum. Then a line is drawn back from the minimum value to the original point. The program does not check your values. MAXIMUM should be a number greater than the original point value and MINIMUM should be a lesser value. If both are left at zero, no separate line is drawn.

These lines are always drawn with color zero and line pitch zero, but can be changed by modifying the generated features.

Multi-Line Chart

Now you're going to learn how to draw a multi-line chart. These charts are especially handy to use when you want to compare several sets of values on the same chart.

Compare the quarterly sales of four paint companies: Company A, Company B, Company C, and Company D. Company A and Company C are the industry leaders and, traditionally, both have reported similar sales increases. Company B is a new company which has shown steady increases in sales. Company D is an old company that has been suffering nearly stagnant sales.

Because the second and third quarters (April through September) are the warmest months of the year, all companies reported their best sales during these quarters. Here are the companies' sales figures:

Quarter	Company			
	A	B	C	D
1	12	6	15	1
2	21	14	20	5
3	18	13	21	4
4	11	12	16	2

From the data, you can see that you'll have four lines (one for each company) and four "periods" (points) in each line.

Enter these for the prompts:

You type:

```
CHART TITLE:                        QUARTERLY COMPARISON
SIDE LABEL:                         PERCENTAGE INCREASE
BOTTOM LABEL:                       QUARTER
PERIODS:                            4
ITEMS/PERIOD:                       4
NAME OF PERIOD   00001:             FIRST
NAME OF PERIOD   00002:             SECOND
NAME OF PERIOD   00003:             THIRD
NAME OF PERIOD   00004:             FOURTH
```

```
DETAILS FOR LINE 00001
      POINTS:
          COLOR:                    0
          SIZE:                     0
      LINE:
          COLOR:                    1
          PITCH:                    0

VALUE FOR PERIOD 00001
LINE             00001:             00012

VALUE FOR PERIOD 00002
LINE             00001:             00021

VALUE FOR PERIOD 00003
LINE             00001:             00018

VALUE FOR PERIOD 00004
LINE             00001:             00011
```

```
DETAILS FOR LINE 00002
     POINTS:
          COLOR:               0
          SIZE:                1
     LINE:
          COLOR:               2
          PITCH:               2

VALUE FOR PERIOD 00001
LINE             00002:       00006

VALUE FOR PERIOD 00002
LINE             00002:       00014

VALUE FOR PERIOD 00003
LINE             00002:       00013

VALUE FOR PERIOD 00004
LINE             00002:       00012




DETAILS FOR LINE 00003
     POINTS:
          COLOR:               0
          SIZE:                2
     LINE:
          COLOR:               0
          PITCH:               5

VALUE FOR PERIOD 00001
LINE             00003:       00015

VALUE FOR PERIOD 00002
LINE             00003:       00020

VALUE FOR PERIOD 00003
LINE             00003:       00021

VALUE FOR PERIOD 00004
LINE             00003:       00016
```

```
DETAILS FOR LINE 00004                              ──You type:
        POINTS:
            COLOR:                      0 ◄
            SIZE:                       3
        LINE:
            COLOR:                      3
            PITCH:                      7

VALUE FOR PERIOD 00001
LINE                00004:            00001


VALUE FOR PERIOD 00002
LINE                00004:            00005


VALUE FOR PERIOD 00003
LINE                00004:            00004


VALUE FOR PERIOD 00004
LINE                00004:            00002
```

Now display the chart in high resolution on your Screen (the last line is in green, so you'll just be able to see the line's points). This chart can be printed out on your dot-matrix Printer or on the Color Graphics Printer (the last line is not printed on black-and-white printers, but is printed on the Color Printer).

Tips about the Line Chart prompts:

- **NUMBER OF LINES** You can have up to 255 lines in a chart but, if you go beyond six or eight, it is difficult to differentiate the lines and the chart will look extremely cluttered.

- **POINT COLOR** Points can be one of four colors (0-3). The specific color depends on the color set of the Screen or Printer.

- **POINT SIZE** The range for point size is 1 (smallest) to 9 (largest). If the size is zero, the points are not drawn.

- **LINE COLOR** Lines connecting the points can be one of four colors (0-3). The specific color depends on the color set of the Screen or Printer. Color 0 is best for the dot-matrix printers.

- **LINE PITCH** Pitch determines the "line style" for your line and ranges from 0-7. For example, 0 is a solid line and 7 is a very finely dotted line. Line pitch does not apply to the display or the Black/White Printers. It only applies to the Color Graphics Printer. (Refer to the Color Graphics Printer Owner's Manual for a discussion of the line pitch/style. Note: The Color Graphics Printer has a line pitch range of 0-15. Disk Graphics line styles are one-half of the printer line styles; i.e., Disk Graphics line style 1 is the same as the Printer's style 2, 2 is 4, 3 is 6 . . . 7 is 14.)

- **VALUE FOR PERIODS** Disk Graphics accepts values from 1 to 30,000 for each point. The line number (item number within the period) and the period number are shown at the top of the Screen for reference.

8/ Key Charts

"Key Charts" are used to add a "key" or "legend" to a Vertical or Horizontal Bar Chart, a Line Chart or a Point Chart. (A Pie Chart already has section descriptions, so a key is not needed.)

Since Key Charts are legends to a chart, they never stand alone. A Key Chart lets you use text alone or text with either a line, box, bar, or point in the key. Keys are especially useful to use on multi-group charts when you need to easily distinguish between the types of bars, lines, or points. After you've perfected your chart, save it on diskette and then start working on your key. (If you want to make any changes to a saved chart, you'll need to load the chart definition before you can edit it.)
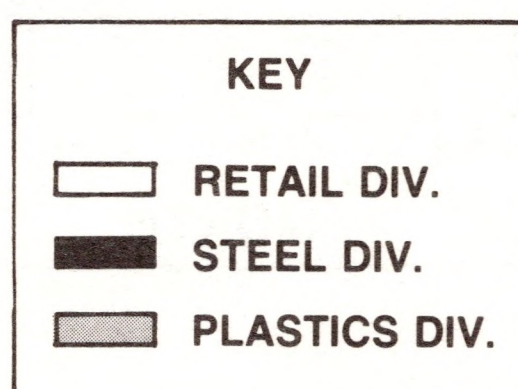
Figure 20.   Key Chart With Bars

To use a Key Chart:

1. You'll have to decide where on the Superscreen you want the Key Chart to go.

2. Move the chart on the Superscreen to fit the Key Chart in.

In the next figure, a chart on a high-resolution Screen is moved 60 Superscreen points up (vertically) and 60 points to the right (horizontally) on the Superscreen.
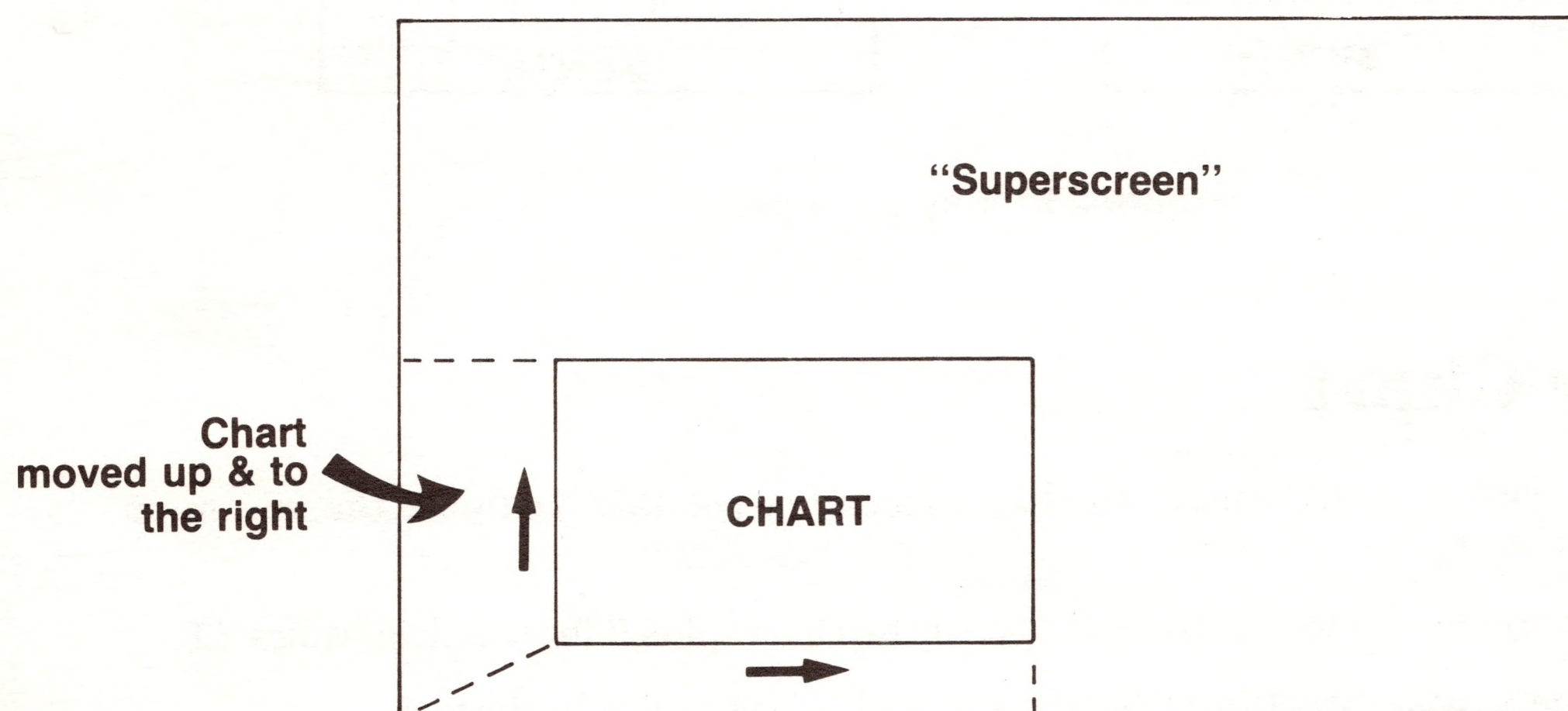
Figure 21.   Moving the Chart

For example, if there is a lot of extra space on the chart, the key can be superimposed on top of the chart.
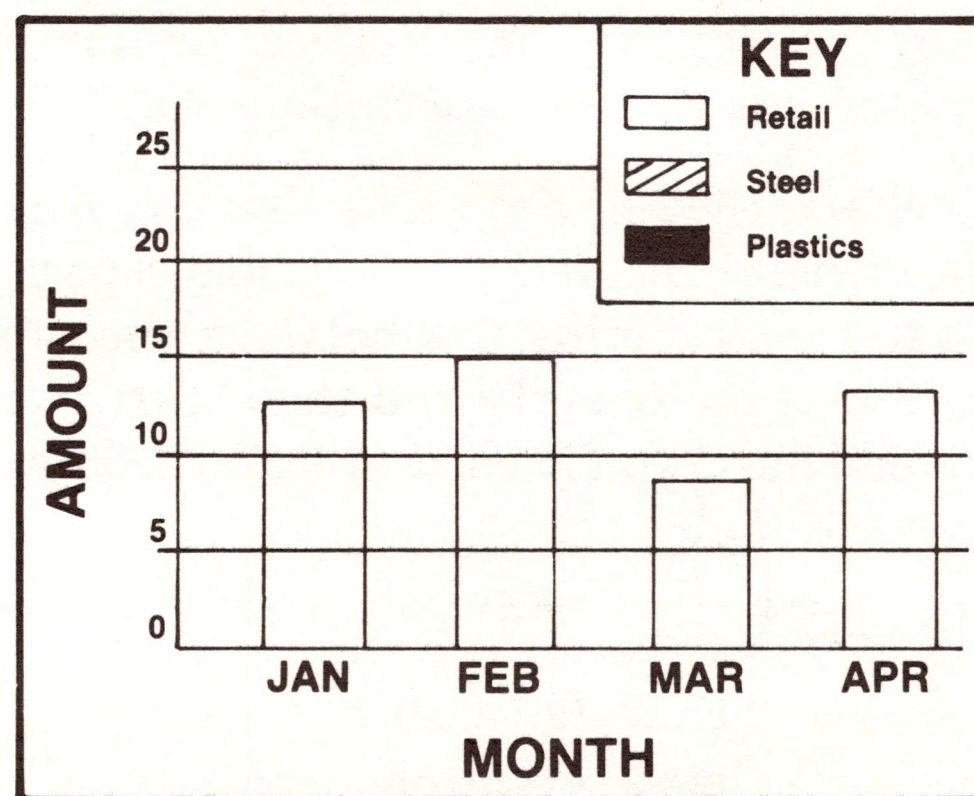
Figure 22. Key Superimposed on Chart

If there's not a lot of room, you can place the key anywhere on the Superscreen, according to your printing needs (you'll probably have to first move the chart on Graphics' Superscreen).
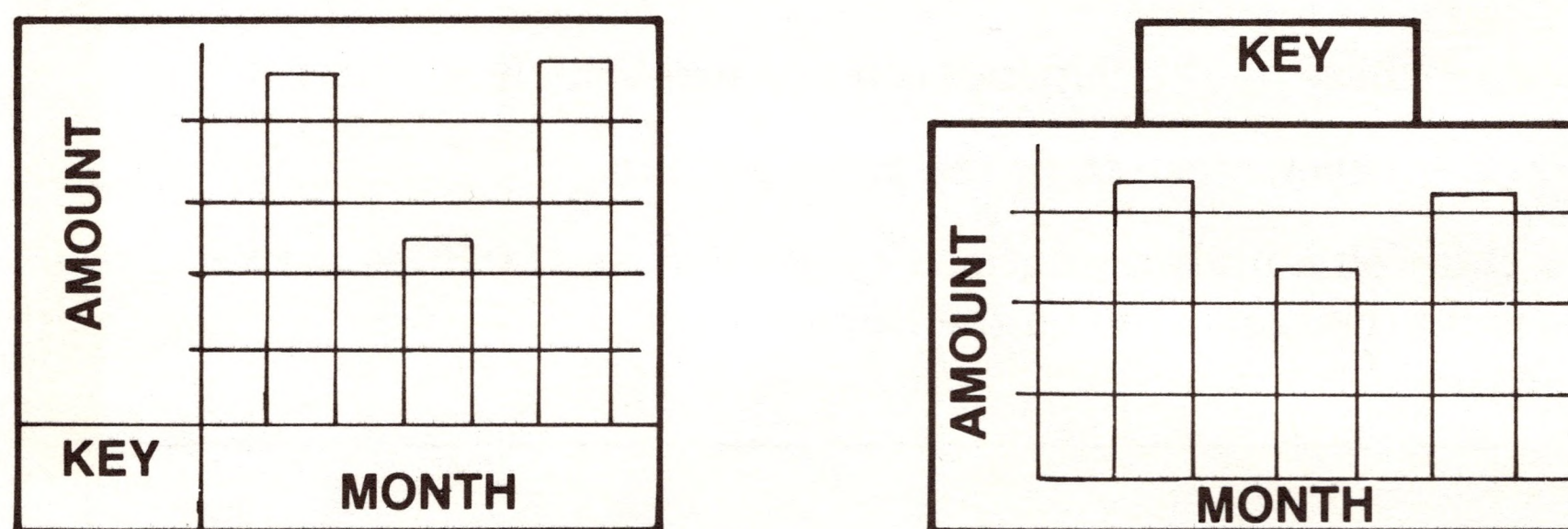
Figure 23. Key Examples

Size of Key Chart

For aesthetics, you'll usually want to make the Key as small as possible. To figure the minimum dimensions of a Key Chart:

1. **For height:** Multiply the number of lines of text in the chart (plus 2 for the title) times 11.

2. **For width:** Use the longest Key Chart description, add 4, and multiply times 6.

Example: You have five items that you want in your Key Chart and the longest description has 10 letters.

1. 7 (number of lines plus 2 for the title) $\times$ 11 = 77

2. 14 (longest key description plus 4) $\times$ 6 = 84

So the chart will have to have a height of at least 77 and a width of at least 84.

PERIODS is the number of items you want to label and is the same as the number of bars, lines or groups of lines in your chart. The key in the preceding example has five "periods".
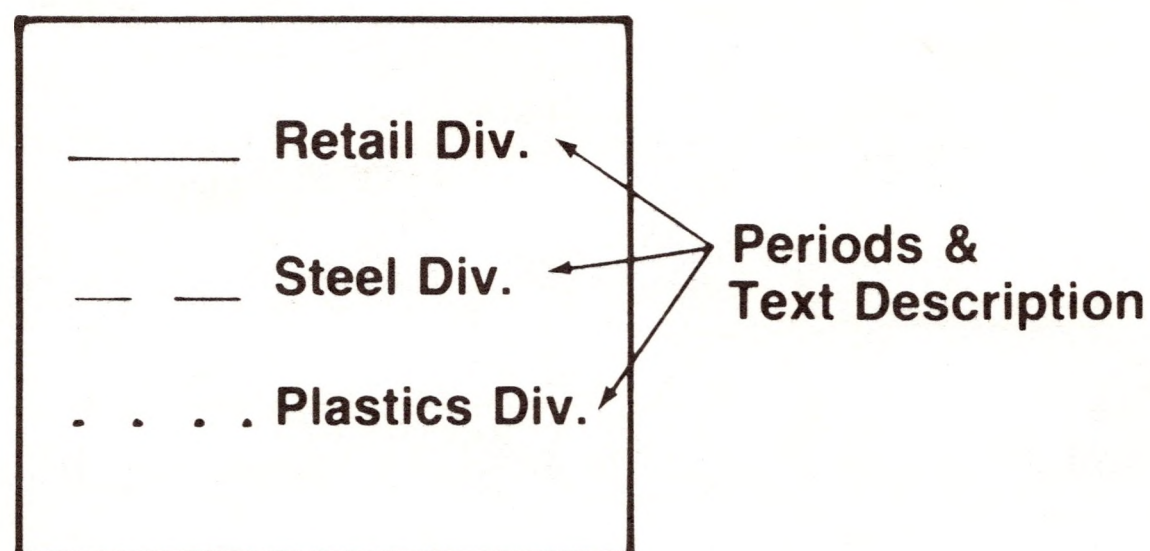
Figure 24. Periods on Key Chart

Look at the main Data Prompts for a Key Chart:


```
LINE                              00001
TEXT/BAR/LINE/POINT (0-3)         [0]
COLOR                             [0]
PITCH                             [0]
SIZE                              [1]
SHADING                           [0]
TEXT
[                                     ]
```

LINE 00001 is the first item in a Key.

TEXT/BAR/LINE/POINT (0-3) asks you what you want in front of the description (0, for text description only, is the default).

Text only (0)   Bar (1)   Line (2)   Point (3)
                                                          (differentiated
                                                          by color and size)
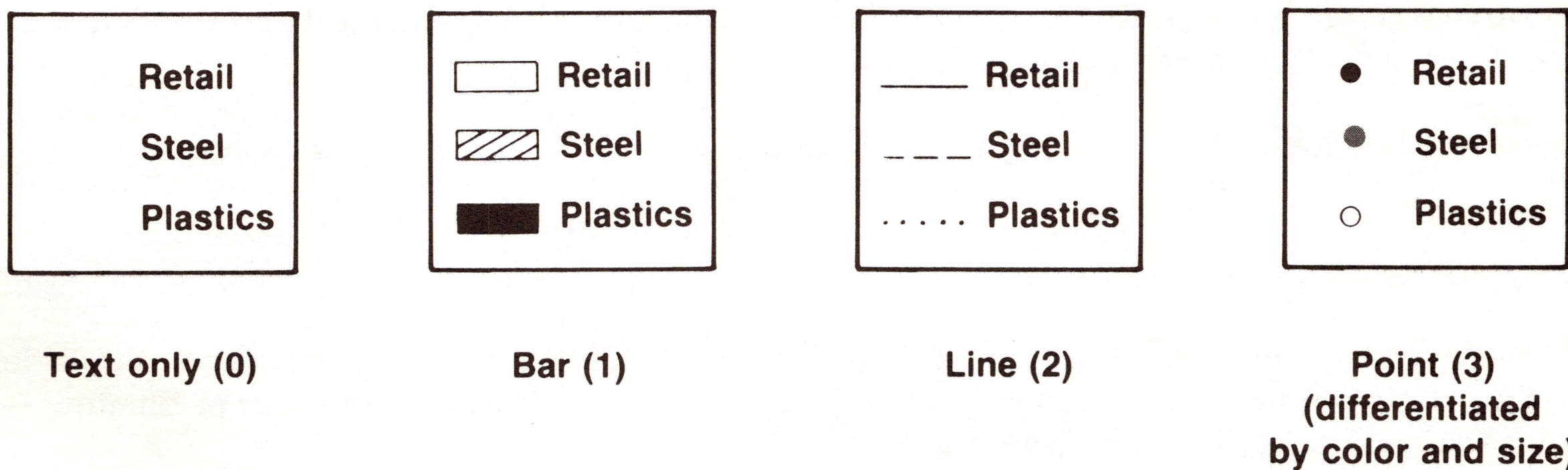
Figure 25. Key Types

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COLOR is the color of the line, point, or bar in the Key. PITCH determines the style of the line. SIZE determines the size of a point and can be from 1-9. As the points become larger, they become boxes:

●   □   □

Size 1   **Size 4**   **Size 9**
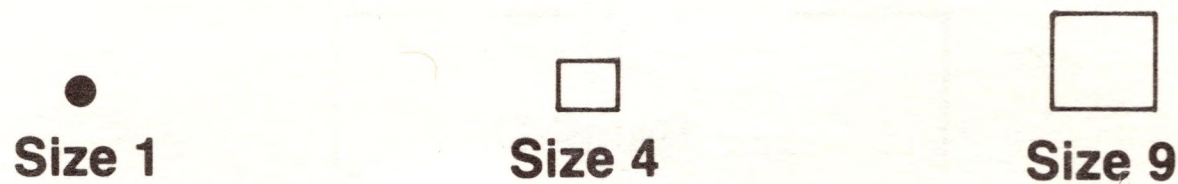
Figure 26.   Example of Points

TEXT is the description of the line as you want it to appear in the Key. There's a description for each item in the Key.

Different types of charts use different Key Chart features:

Feature	Bars	Lines	Point	Text Alone
color	✔	✔	✔	not applicable
shading	✔			N.A.
pitch		✔		N.A.
size			✔	N.A.

Table 4.   Key Chart Features

Drawing a Key Chart

To draw a Key Chart:

1. Draw a chart and move it to a location on the Superscreen so that you can fit the key on the Superscreen.

2. Figure the size of the Key Chart you need and create a Key Chart. For the chart title, use KEY or LEGEND. This title is centered at the top of the Key Chart.

Sample Session

For an example of a Key Chart, first do a Horizontal Bar Chart plotting the monthly profits over a three-month period for the three divisions that compose Acme Inc.:

	Retail Div.	Steel Div.	Plastics Div.
JAN	11	9	7
FEB	15	13	18
MAR	4	2	8

Be sure the chart's dimensions are 191 for the height and 255 for the width and the chart's lower-left corner is at 0,0. If you need help, see Chapter 6. (You don't have to worry about Color or Shading — this is done automatically by Disk Graphics.)

Now add a Key Chart:

1. Display the Main Menu and press: ② ② ①.

2. From the TYPE OF CHART menu, press: ⑤.

3. A group of prompts appears on the screen. Answer these prompts as follows:

   - For the CHART TITLE prompt, type: KEY.

   - For the CHART HEIGHT prompt, type: 95.

   - For the CHART WIDTH prompt, type: 108.

   - For the CHART UP POSITION prompt, type: 192.

   - For the CHART RIGHT POSITION prompt, type: 75 (ENTER). (This centers the Key Chart on top of the Bar Chart.)

4. On the next screen of prompts:

   - Press (3) for PERIODS.

5. The TEXT/BAR/LINE/POINT (0-3) prompts are now displayed. A new set of these prompts will be provided for each line in the Key Chart. Respond as indicated below:

   - For the first-line prompts, press: (1). (This gives you a bar in front of the description in the Key.) Move the Cursor to TEXT and type: RETAIL DIV. (ENTER).

   - For the second-line prompts, press: (1). Move the Cursor to SHADING and press: (1). Move the Cursor to TEXT and type: STEEL DIV. (ENTER).

   - For the third-line prompts, press: (1). Move the Cursor to COLOR and press: (1). Move the Cursor to TEXT and type: PLASTICS DIV. (ENTER).

6. Display the charts in high resolution. Since the Key is over the chart, you'll have to use Image Size Reduction: 1 to see the Key Chart. Try printing the chart on your dot-matrix printer or Color Graphics Printer. (For the dot-matrix printer, type: 315 for the MAXIMUM 'Y' USED prompt.)

Note: Before printing it on a dot-matrix printer, you must display your chart without scale reduction. If you don't, it will be reduced on the dot-matrix printer and may be unreadable.

9/ Point Charts

Point Charts, or scatter diagrams, are used to show the relationships between specific items. They generally require that a large amount of information be entered and are likely candidates for being produced with the aid of a BASIC program.

Point Charts are often used to "look for" a subtle relationship between items. For example, a chart might be produced that places a point on the chart for each person in a department. The vertical position could indicate the person's salary, while the horizontal position could indicate the months of service with the company. If enough points are plotted, one might expect the points to gather around an imaginary line that runs upward from left to right. In other words, the longer the service, the higher the salary.

Defining a Point Chart starts the same as Line and Bar Charts. After entering the title, size, and position, you supply the side and bottom labels. (For example, the side label could be SALARY and the bottom label could be MONTHS OF SERVICE. Then the number of points to be plotted is entered. If you have 255 points or less, enter the number in *either* the PERIODS prompt or the ITEMS PER PERIOD prompt (leave the other with a value of 1). If you have more than 255 points, use the two in combination. The product (result of multiplying together) of the two is the number of points to plot. 750 points, for example, can be plotted by entering 75 in PERIODS and 10 in ITEMS PER PERIOD.

The next set of prompts looks like this:

```
VALUES FOR POINT #00001

HORIZONTAL [00001]
VERTICAL   [00001]

POINT SIZE [1]
COLOR      [0]
```

Continuing with the previous example, point 1 is information about the first person to be plotted. The horizontal value is the months of service. The vertical value is the salary. (Point size and color will be discussed later.) After entering the information for this person, press (ENTER) and repeat the process for all other people being plotted. After the last one has been entered, you will be returned to the Main Menu. You can then display the results.

The results are different from bars and lines in that there are *two* scales printed — one vertical and one horizontal (like a piece of graph paper).
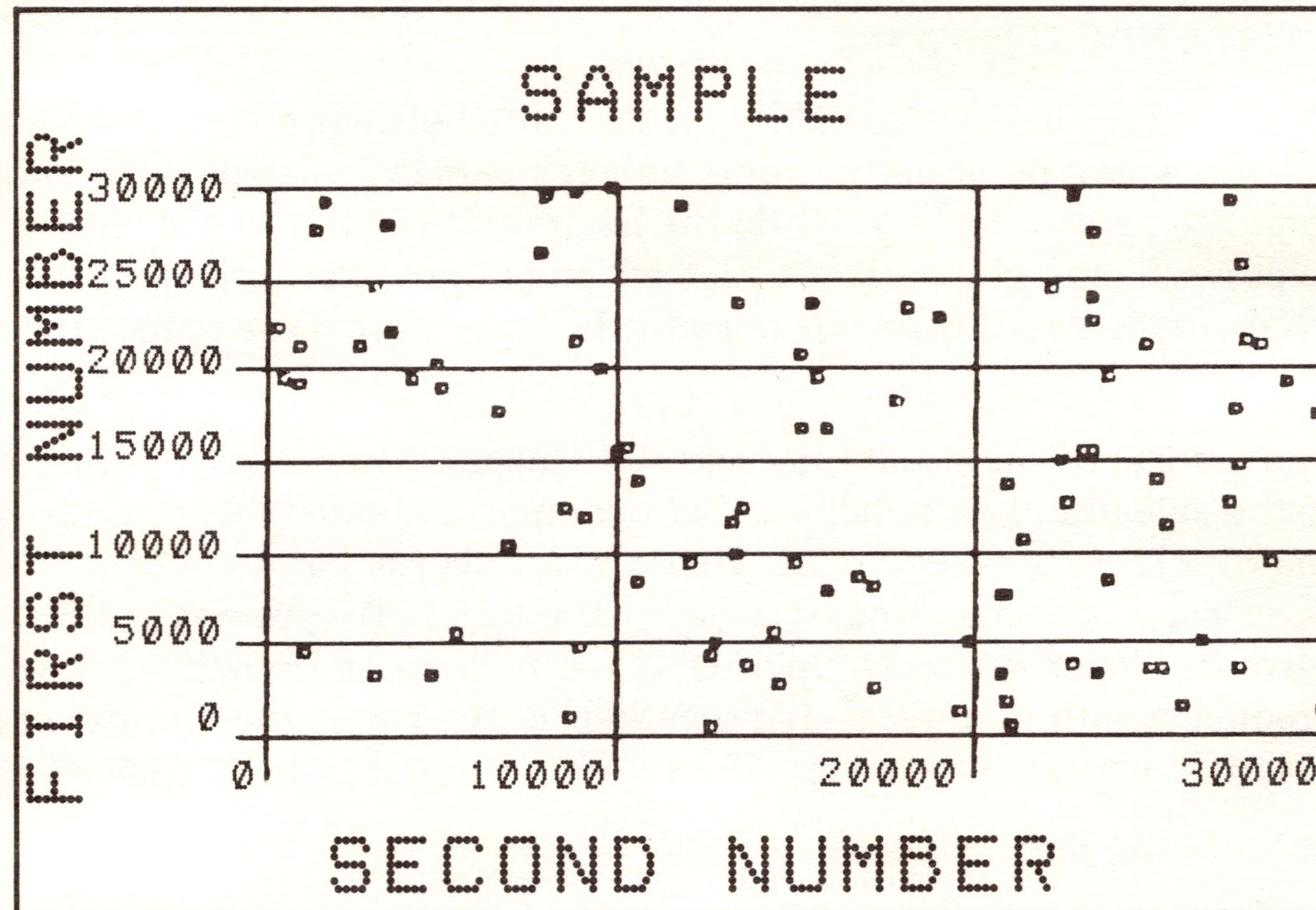
Figure 27.   Point Chart

Additional information can be shown on a Point Chart by using the point size and/or color to show a third or even fourth variable. For example, male employees could be shown with blue points and females with red points (best done on the Color Graphics Printer). In addition, age could be shown by using point size, with size 1 representing employees under 25, size 2 for those 26-30, size 3 for those 31-35, etc. As a result, a chart can be drawn that gives an instant "feel" for the type of people in the department.
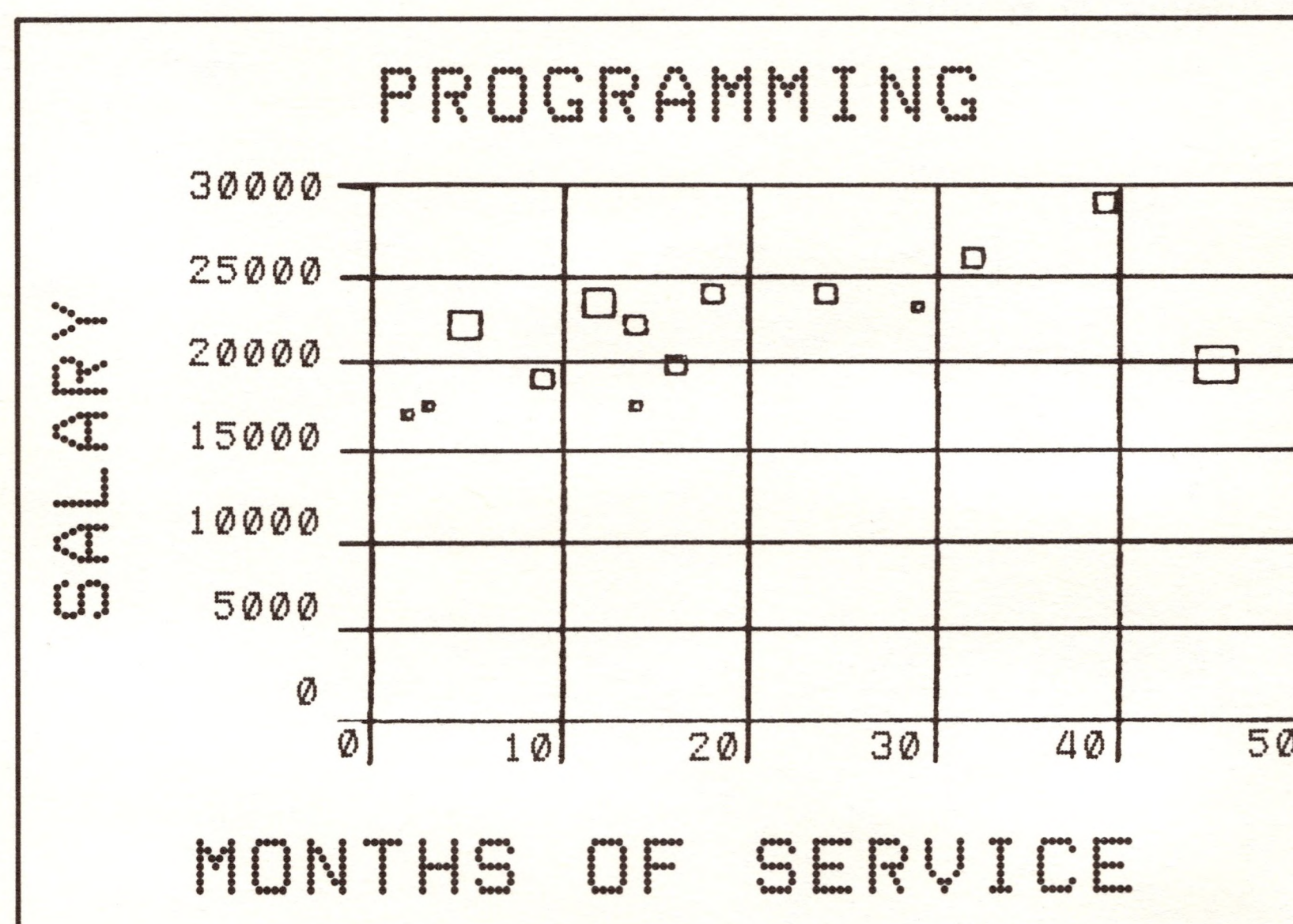
Figure 28.   Point Chart with Point Size Variable

Hints About Point Charts

The generated features require less space if you presort your information so that you enter all items with the same point size and color together. As long as these items are the same, only a "point" feature (5 bytes) is generated. Each time you change to a new color or size, a "set defaults" feature (5 bytes) is generated, and then the "point" feature is also generated (for a total of 10 bytes).

You can control the upper limit of the scales by entering a single point containing a value you want represented at the upper-right corner (all other points should be less than this value). Use size zero for this point. It will not be shown but will affect the scale.

10/ Displaying/Printing

You can display/print charts in all of the following ways:

- Four-color low-resolution Screen (96 × 128) with three-color shading.

- Two-color high-resolution Screen (192 × 256) with three-color shading.

- Dot-matrix printer with graphics capabilities. Three types of shading are possible.

- Color Graphics Printer.

Image Size Reductions

Image Size Reductions was discussed briefly in Chapter 3. Reducing the "Screen image" (by reducing the size of the Superscreen) is especially useful when building charts for the Printer that are larger than the dimensions of a high-resolution Screen (191, height; 255, width).

When you reduce the image, you can see a "scaled down" version of the chart, exactly as it'll be printed on your Printer.

Image Size Reduction has a range of 0 (full sized) to 3 (1/8 of the original Screen size). There is a loss of resolution when images are reduced. For example, when an image is reduced to one-half its original size, only every second point of every second line is displayed. Likewise, with one-fourth or one-eighth reductions, every fourth or eighth point of every fourth or eighth line, respectively, is displayed.

Number	Reduction Size
0	full-sized
1	1/2 of original
2	1/4 of original
3	1/8 of original

Table 5.   Reduction Chart
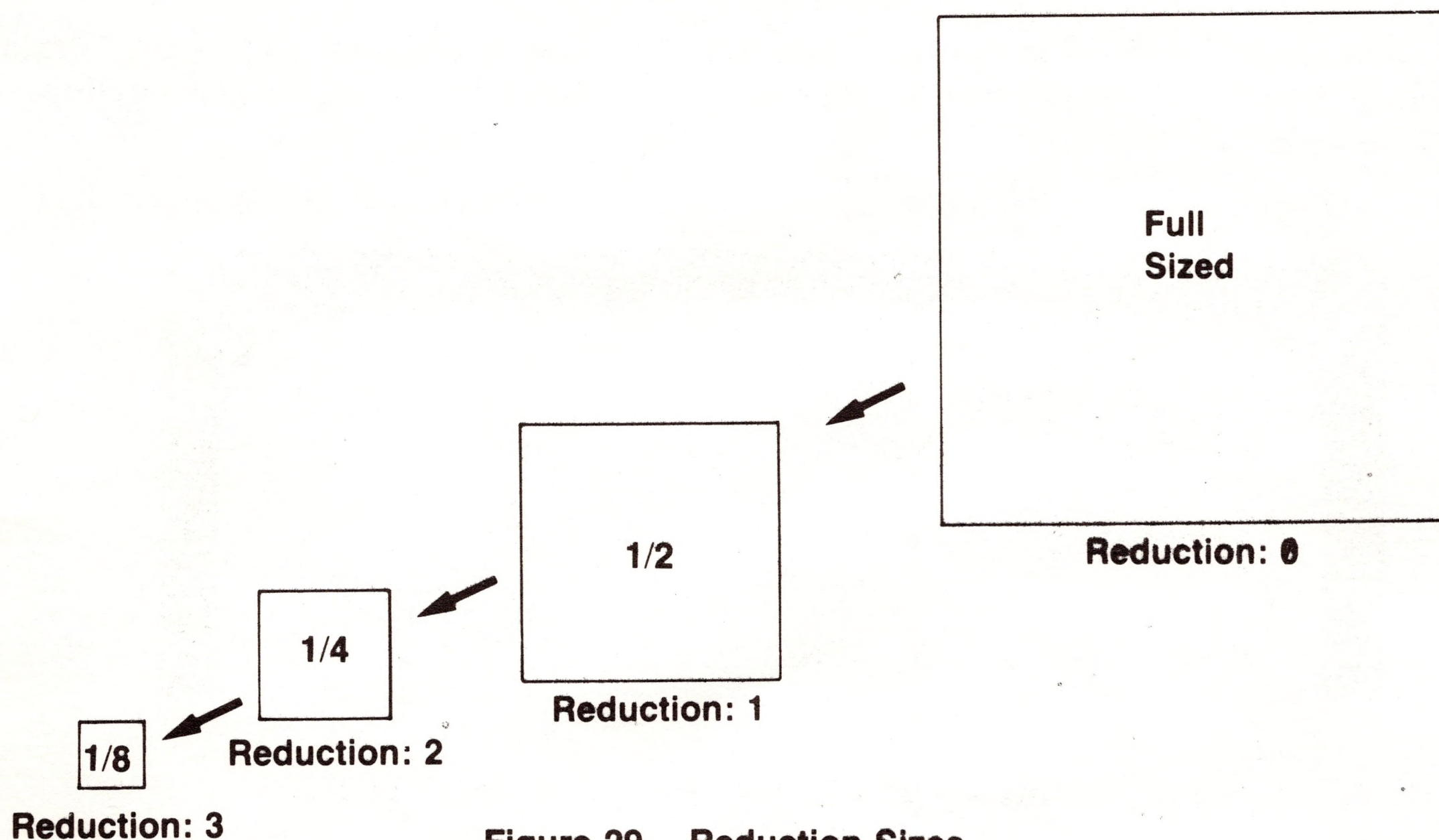
Figure 29.   Reduction Sizes

Example: When you enter ① for the reduction size, Graphics shrinks the Superscreen to 1/2 its width and 1/2 its height (total reduction: 1/4 of original). You have much less detail with reductions but, in this case, you get to see four times as much of the Superscreen on the high-resolution Computer Screen.

Note that when you reduce a chart's image, you do not change the chart's dimensions; you are simply "making a reduction" of the Superscreen, just like you can do on some photocopiers.

For example, if you are building a large chart for a printer, you can only see parts of it on the high-resolution Screen. By reducing the image, you can get a look at the chart's "total picture" and make sure it's correct before you print.

Sample Session

Go through a practice session where you draw a Pie Chart and display the chart in all four ways.

Title the chart: **ABC SHOE CO. FEB. SALES.**

These are the February sales figures:

casual	$2,738
athletic	$2,159
boots	$2,066
dress shoes	$1,532
house shoes	$1,285

Enter the figures and section titles. The section descriptions are: casual, athletic, boots, dress shoes, and house shoes. For each section's "size", enter the respective sales figure for that month (don't enter the comma or the dollar sign).

Boots are a new line for the ABC Shoe Company and did quite well during the winter month of February. To highlight this, color the boot section with Color 1 and enter ① for Shading Exception (this will shade this section). Also offset the section by 15 points. When all the information is entered, you'll be returned to the Main Menu. To display each type of chart, press: ⑥ from this menu.

Low-Resolution Screen

A low-resolution Screen has 96 pixels on the Y-axis and 128 pixels on the X-axis. From the Display Method Menu, press: ①. Before displaying a chart on a low-resolution Screen, the chart definition should specify a height of 95 and a width of 127.

When you display charts in low or high resolution, this series of prompts is listed on your Screen:

```
DISPLAY WINDOW LOCATION
(LOWER LEFT CORNER)

        X                              [      ]
        Y                              [      ]

IMAGE SIZE REDUCTIONS              [   ]
```

Press: ① (ENTER), and the chart is displayed. The "boot section" is shaded in blue.

The X and Y values indicate what part of the Superscreen is to be displayed on the Screen (the lower-left corner is 0,0). If you do not enter any values for X and Y, Disk Graphics draws as much of the chart (starting in the lower-left corner) as possible.

You only need to enter values here if you want to move the window through which you view the chart. Move the window slightly by entering 20 for X and 20 for Y. Display the chart in low resolution. All of the chart is visible except for the lower-left corner of the Superscreen.

CHART POSITION (part of the chart definition) determines where on the Superscreen the chart is placed. DISPLAY WINDOW LOCATION determines what part of the Superscreen is displayed.

High-Resolution Screen

In high resolution, there are 192 pixels on the X-axis and 256 pixels on the Y-axis. To draw the chart in high resolution, from the Display Method Menu, press: ②. From the prompts, press: [ENTER] and the chart is drawn. In high resolution, the "boot section" is shaded in light gray.

Change the Image Size Reduction to 3. The chart has been shrunk to 1/8 its original size.

Color Graphics Printer

With the TRS-80 Color Graphics Printer, Model CGP-115 (26-1192), a chart can have a width of 0 to 999 and a height of 0 to 950.

The Color Graphics Printer lets you print:

- Extra-tall charts (up to a maximum of 950).

- Extra-wide charts (to the 999 maximum).

- A combination of both extra-wide and extra-tall charts over two sheets of paper (which you'll attach with cellophane tape).

```
(0,950)                              (999,950)

        Two-Sheet Maximum
        (999, width;
        950,height)

(0,480)                              (999,480)

        One-Sheet Maximum
        (999, width;
        480, height)

        ← Paper feeds in this direction
          from the printer
(0,0)                                 (999,0)
```
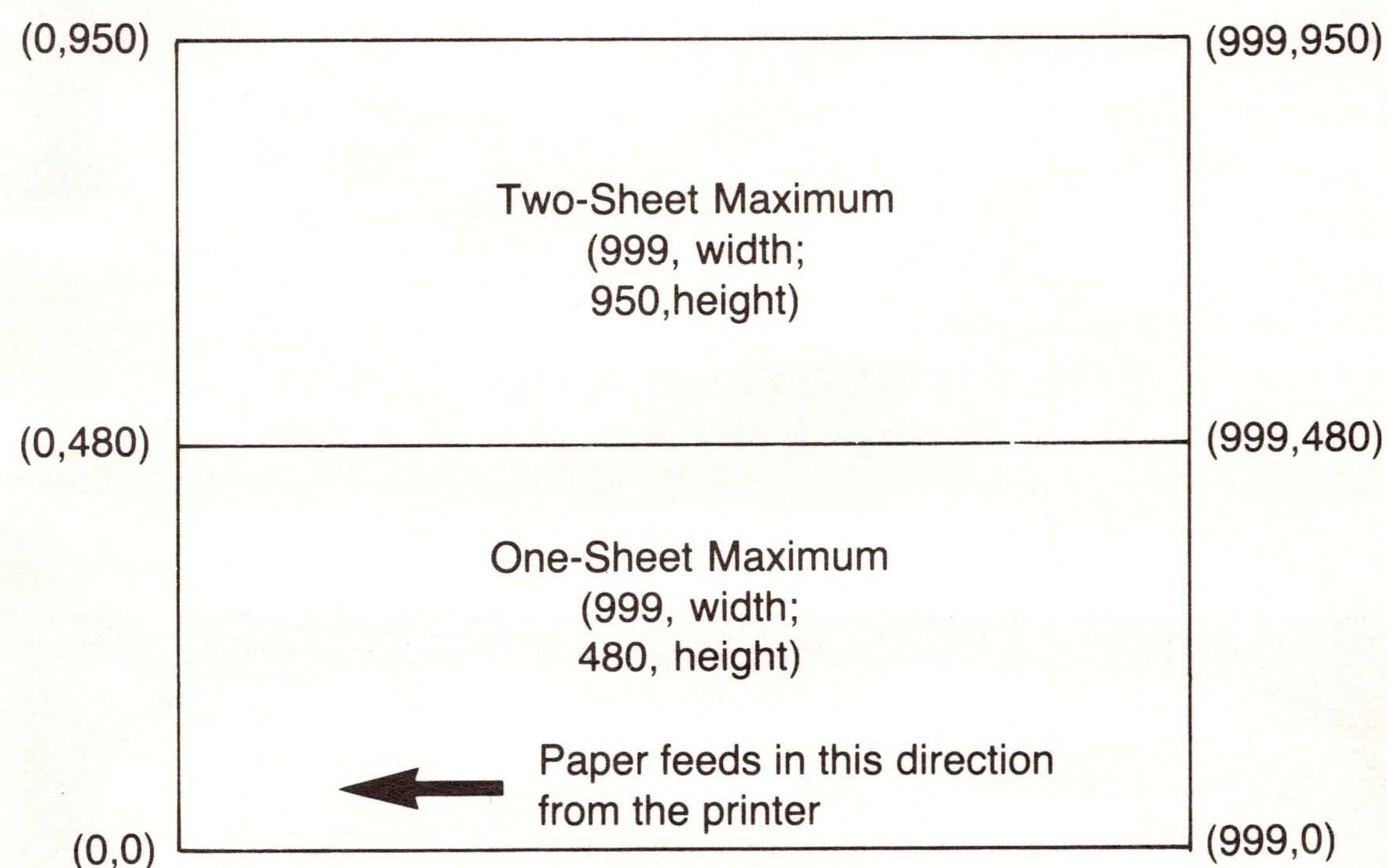
Figure 30.   Extra-Wide, Extra-Tall Printing

It is important to remember that the Color Graphics Printer turns all charts and labels 90 degrees from the way they appear on the Color Computer Screen.

From the Display Method Menu, you can see there are two choices for a Color Graphics Printer:

- 5. 480 x 999 4 COLOR PRINTER

- 6. COLOR PRINTER (UPPER 1/2)

Unless you're going to make your chart taller than 480, it will fit on one sheet of paper and you'll select Display Method Menu Selection: ⑤.

If it's taller than 480, you'll first select Display Method Menu Selection: ⑤ (which prints the "bottom half of the chart"), and then you'll select Display Method Menu Selection: ⑥ (which prints the "upper half" of the chart). You'll then have to tape the two sheets of paper together to have a completed chart. The two halves will overlap by 10 Superscreen points to aid in aligning the two halves.

Special Notes about Printing:

- On extra-wide charts, the paper on the Color Graphics Printer has a tendency to "wrap into" the Printer during printing, causing distortion. Be sure to have the Paper Separator correctly in place to prevent this wrapping.

- As a sensitive plotting instrument, the Color Graphics Printer works best with smaller charts. As a rule, the wider and taller a chart is, the greater the chance for some distortion.

Procedure for Printing:

1. First you have to decide what you want the dimensions of your chart to be. If a chart is especially tall (over 475 points), you'll have to print it out over two sheets of paper.

2. Then you'll have to change the chart's dimensions to fit your needs by Creating or Editing the chart. From the Main Menu, press: ② (CREATE A CHART), then: ① (to Edit) or ② (to Create). Then you may set or change the chart's default size:

```
OVERALL CHART SIZE:
    HEIGHT                          [00191]
    WIDTH                           [00255]
```
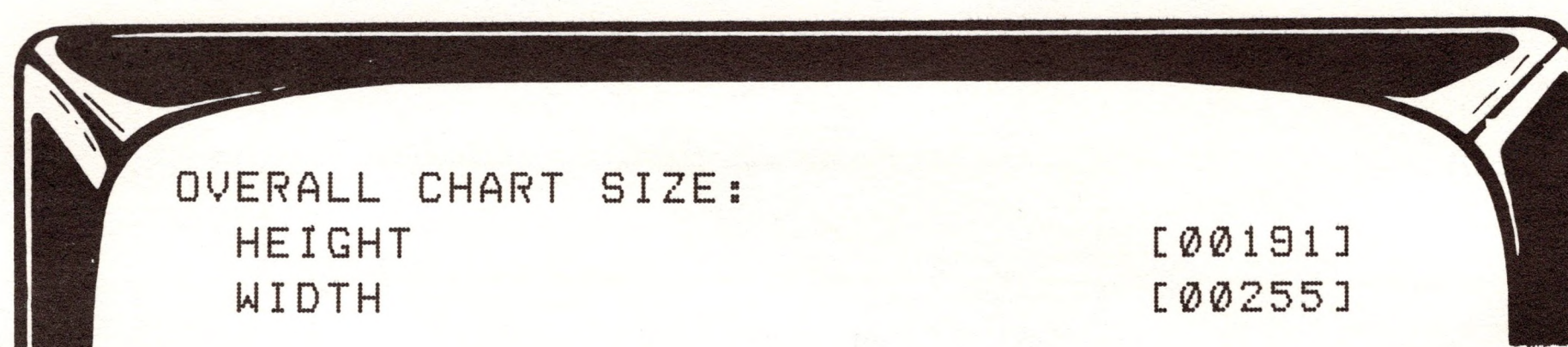
Wide Chart

Print your Pie Chart out on the Color Graphics Printer as wide as it will go. First, you'll have to edit the chart's dimensions. From the Main Menu, press: ② (CREATE A CHART), then: ①. Move the Cursor up and change the chart's height to 470 and the width to 999. Enter these dimensions in the size prompts:

```
OVERALL CHART SIZE:
    HEIGHT                          [00470]
    WIDTH                           [00999]
```
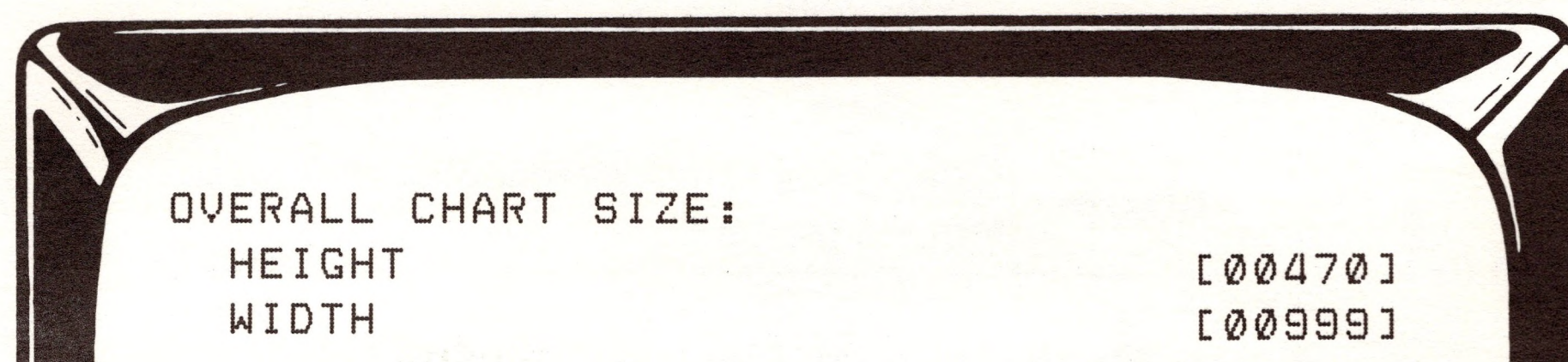
These dimensions take advantage of the wide height and width capabilities of the Color Graphics Printer.

To print:

1. Be sure the Printer is connected and turned ON.
2. From the Main Menu, press: ⑥.
3. From the Display Method Menu, press: ⑤. The chart's Features are flashed on the Screen as they are "translated" and sent to the Color Graphics Printer. When printing is completed, the Main Menu returns to the Screen.

Medium Square Chart

Change the chart's height to 400 and the width to 400. This prints a chart that is square.
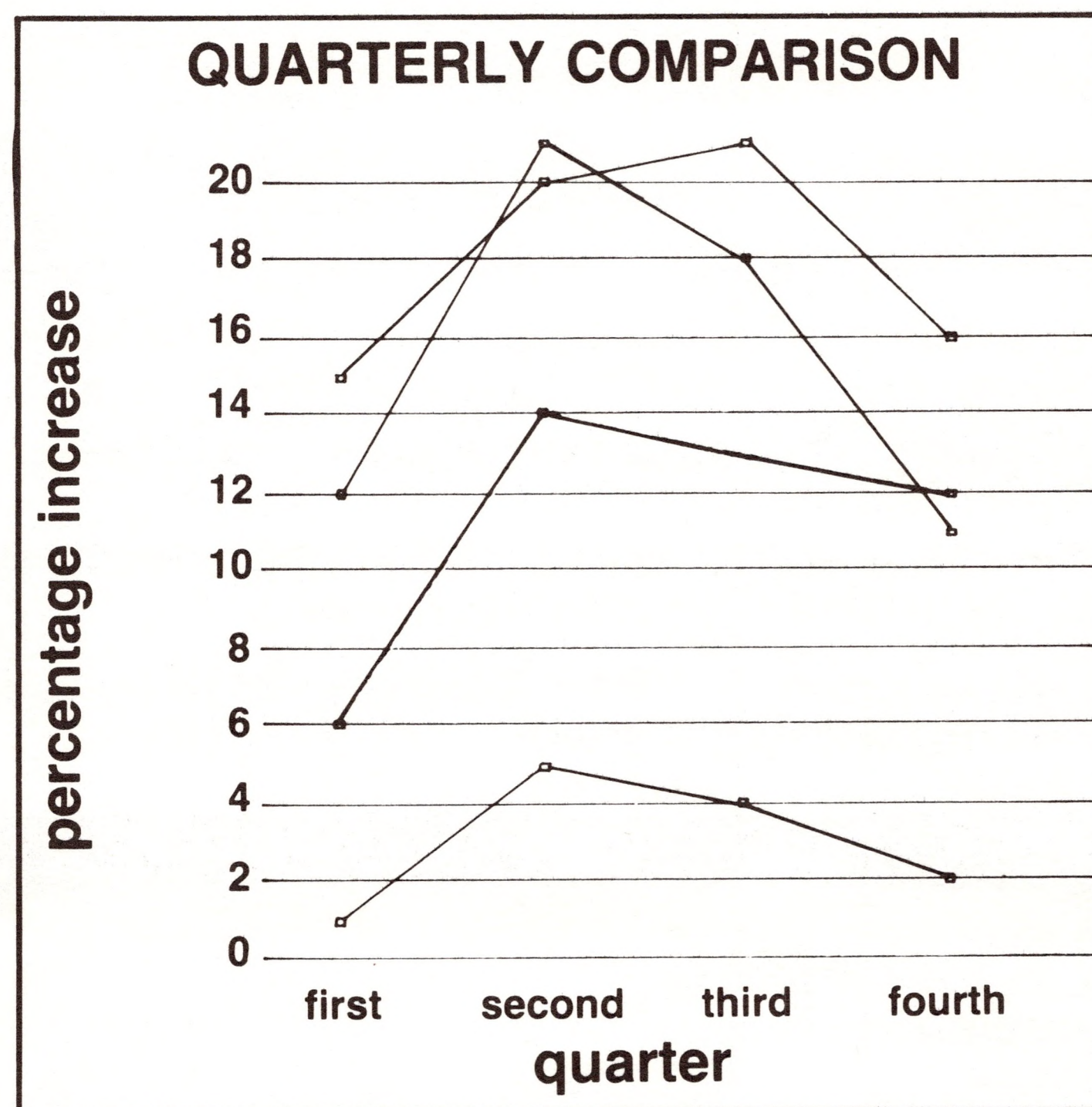
Figure 31. Square Chart

Extra-Wide and Extra-Tall Charts

To print this chart at the maximum size, change the chart's height to 950 and its width to 999. Then print once using Display Method Menu Selection: ⑤ (which prints the "bottom half" of the chart), and again with Display Method Menu Selection: ⑥ (which prints the "upper half" of the chart). Then tape the two halves together.

Dot-Matrix Printers

You may use dot-matrix printers with graphics capabilities to print your Disk Graphics displays. The printers can print heights to 999 and can use the entire Superscreen for extra-wide printing over two sheets of paper.

Menu Selection ③ (999 x 480 B/W PRINTER) lets you print the left half of a display that is up to 999 in height and 480 in width. Menu Selection ④ (B/W PRINTER (RIGHT HALF)) lets you print the right half of a display that is up to 950 wide on the second sheet of paper. After they are printed, you can tape the two sheets together.

(0,999) (480,999) (950,999)

```
+---------------------------------+---------------------------------+
|                                 |                                 |
|                                 |                                 |
|   One-sheet maximum             |   Two-sheet maximum             |
|   with dot-matrix printers      |                                 |
|   with graphics capabilities.   |                                 |
|                                 |                                 |
|                                 |                                 |
|                                 |                                 |
|                                 |                                 |
+---------------------------------+---------------------------------+
```
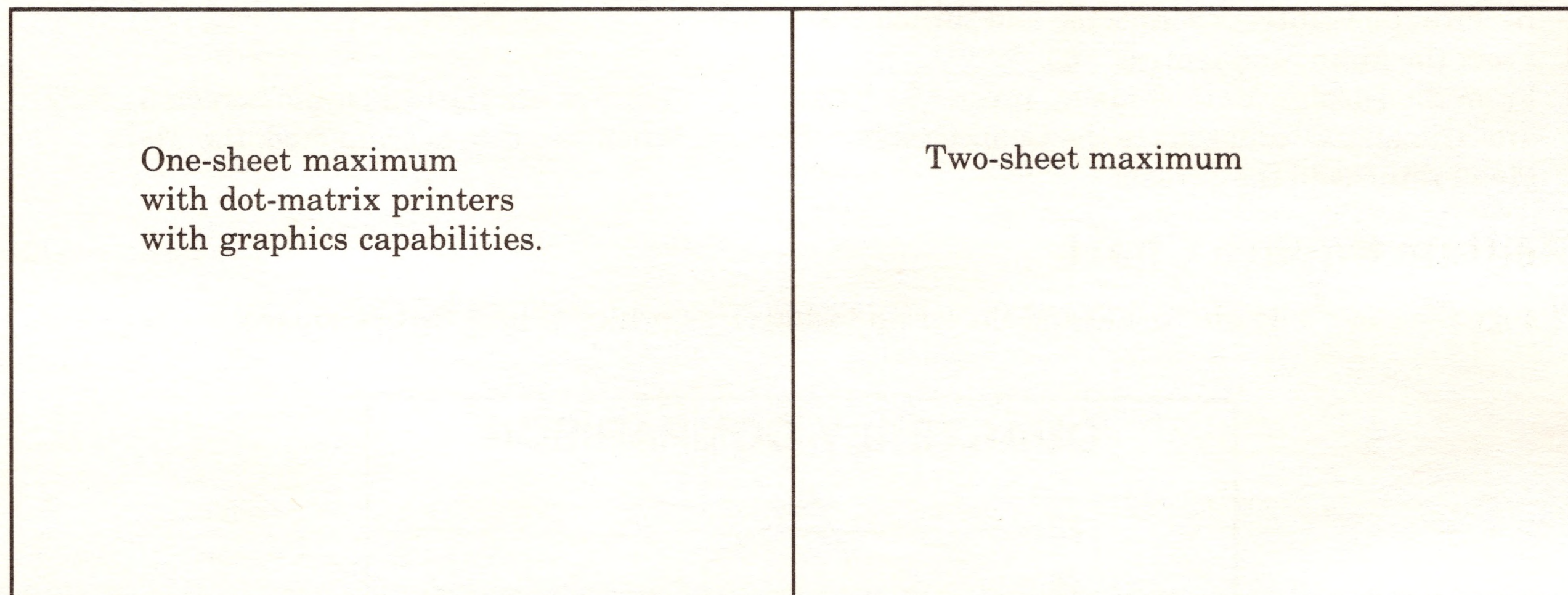
(0,0) (0,480) (950,0)

Figure 32.   Two-Sheet Extra-Wide/Extra-Tall Chart

When you draw (or edit) the chart, you'll have to decide how tall and wide you want the chart to be. Then you'll have to be sure you tell the Printer these dimensions.

For example, if you want to print a chart that's 800 x 650, you can get these dimensions by entering the values for the chart's size (in the first chart prompt):

```
OVERALL CHART SIZE:
   HEIGHT                          [00800]
   WIDTH                           [00650]
```
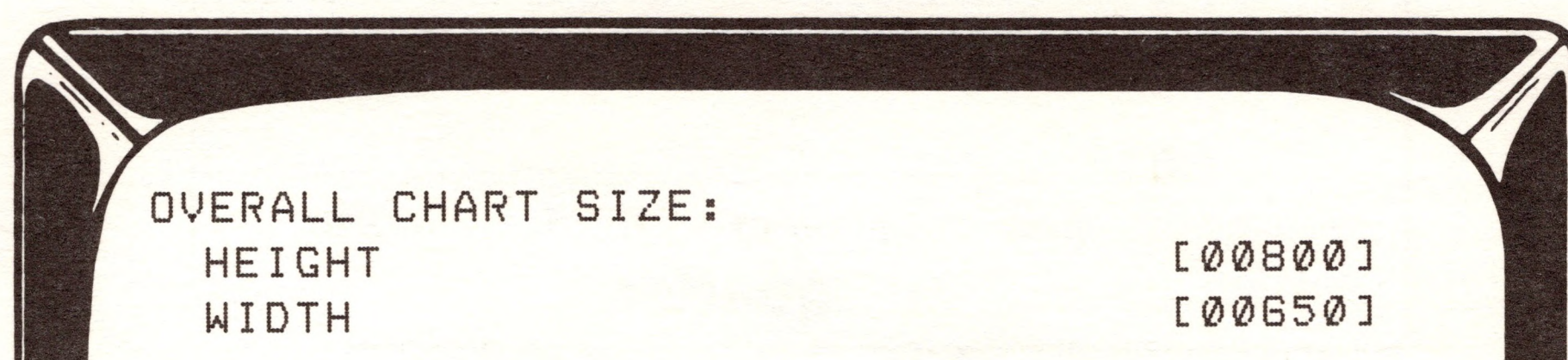
To print with a dot-matrix printer:

1. Draw (or load from diskette or cassette) the chart.
2. From the DISPLAY METHOD? prompt, press: ③.
3. The next prompt (MAXIMUM 'Y' USED) lets you decide how much of the Superscreen to print. If the chart fills the high-resolution display, use 195. If you have specified different chart sizes when you built the chart, you will have to tell the Printer these dimensions.

As soon as you tell the Printer the height of the chart, the Screen changes to the green graphic Screen and fills with graphics-looking lines and dots. The chart is then printed in sections. Each section is loaded into the program's buffer and printed. As a section is sent to the Printer, the dots disappear. Then the procedure is repeated.

Each time it goes through the process, 14 print lines (98 Superscreen lines) are processed. When printing is finished, the Main Menu appears. If you need to stop printing anywhere along the way, just press BREAK and you'll get back to the Main Menu.

Wide Charts

The maximum "one-sheet" printing width with a dot-matrix printer is 480. If you have created a very wide chart (over 475 points wide), use Display Method Selection: ④ (B/W PRINTING (RIGHT HALF)) to print the right half of the Superscreen.

When you do this, there's a slight overlap (10 Superscreen Points) which helps you "line up" the two halves of paper when you tape them together. This lets you have a maximum printing width of 950 points (480 + 480 – 10), which is nearly two full sheets of paper!

Plot a Line Chart and print it on a dot-matrix printer. This chart will plot the population of "Anytown, USA" from 1940 to 1980. Here are the figures:

1940	2,236
1945	3,115
1950	5,248
1955	6,077
1960	7,919
1965	8,644
1970	11,606
1975	13,540
1980	11,498

Title the chart ANYTOWN POPULATION. From the OVERALL CHART SIZE prompt, for height, type: 700, and for width, type: 450. For the side label, type: NO. OF RESIDENTS. For the bottom label, type: YEAR. For periods, type: 9.

Name the first period: 40. Name the second period: 45, etc., until all periods have been labeled. On the next prompts, for the Line Color, type: 2.

Type in the values for each period and you're back at the Main Menu. Your chart is ready to display. Take a look at it in high resolution before you print. Only the lower-left corner of the chart is visible. Always display the chart with no scale reduction before printing or it will be printed in the reduced size.

To print:

1. Be sure the Printer is set for 8-bit serial to print graphics (see your Printer's owner's manual).
2. From the DISPLAY METHOD? prompts, press: ③.
3. The next prompt (MAXIMUM 'Y' USED) lets you decide how much of the Superscreen you want to print. Since you set the chart on the Superscreen as being 700 tall, you'll need a slightly larger value here. Type: 720 (ENTER) and printing begins.

   Note: To print a chart further right on the paper, change the chart position on the first screen of your chart definition.

When Using a 32K Color Computer...

When you use a 32K Color Computer, printing takes advantage of the extra memory available in a 32K Computer. Since the Disk Graphics program can generate output for the Printer faster than it can be printed, the extra memory is used to store output until the Printer catches up.

As a result, it is possible to get over ten minutes ahead of the Printer. Instead of doing nothing while the Printer is running, Disk Graphics allows you to go on with your work.

After "printing", the program will display how much data remains in memory to be sent to the Printer. You will see the numbers counting down as information is sent to the Printer. When the display reaches zero, the Main Menu will appear automatically. If you want to cancel the remaining printing, press ②. The Printer will stop and the Main Menu will appear.

If, however, you want to go on with your work of creating, saving, loading, displaying, and printing charts, press ①. The Main Menu will appear and you can continue working while the Printer continues to print. Each time you return to the Main Menu, you will first see how the Printer is doing and have an opportunity to cancel the rest of the printing. If you are looking at the Main Menu and decide you want to check up on the printing, press ① (BREAK).

Important Notes:

- Before every line, Disk Graphics sends a command to the Printer that shifts it into Graphics Mode. If you want to use the Printer for normal printing, turn it OFF and then back ON.
- Since dot-matrix printers have outstanding resolution (480 addressable dots horizontally on one sheet of paper), they take a little longer to print a graphics display.
- On the MAXIMUM 'Y' USED prompt (which is asking for how much of the Superscreen's height is to be printed), always add 10 to the maximum height of your chart. For example, if you have a chart that's 600 x 400, use 610 for the height so you'll be sure to get the entire chart printed.

11/ Chart Features

From your chart definition, Disk Graphics generates a set of "Features" that defines the points, lines, text strings, etc., from which your chart is actually printed or displayed.

By editing the Features, you can "customize" a chart to fit your special needs. Save a copy of the changes you make to the Features on a disk work file.

For example, if the bottom label doesn't look right, you can change its size, color, or location by modifying the generated Features.

Creating your own Features is especially handy when you want to add a company logo, business seal, trademark, slogan, etc., to your chart. As you become more familiar with Features, you'll see you can create just about any kind of image you want by combining points, lines, rectangles, arcs, circles, etc.
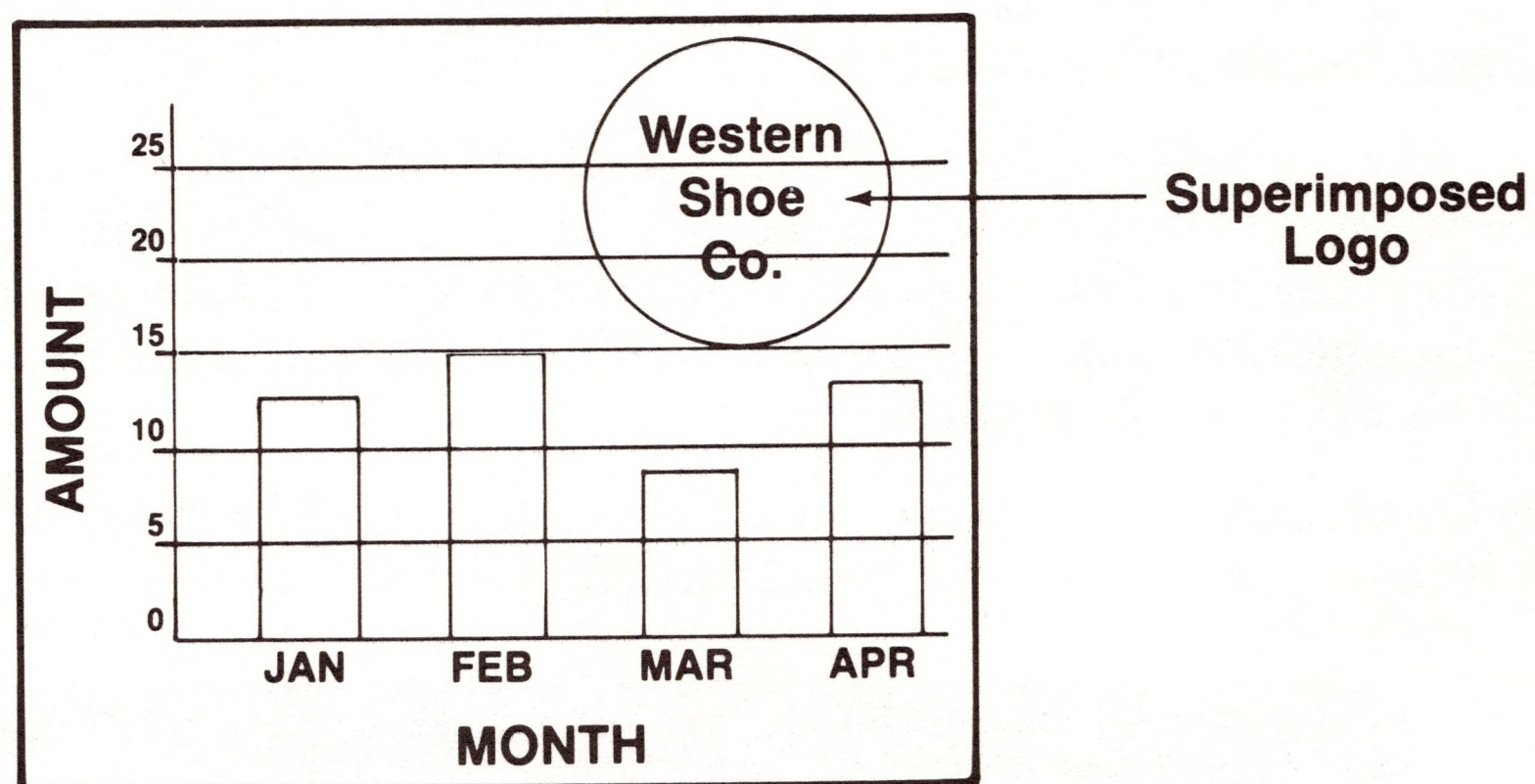
Figure 31.   Company Logo and Bar Chart

Editing Keys

There are four keys you can use when you are editing Features:

(SHIFT)(↓)	the next Feature is displayed on the Screen.
(SHIFT)(↑)	the previous Feature is displayed on the Screen.
(→)	scrolls forward to the next "remark" Feature or to the end of Features, whichever comes first.

You can use Features three ways:

- To add new features that are superimposed on a chart (such as a company logo).
- To display or print the Features independently of a chart's definition.
- To change the generated Features for a "customized" look.

Once you choose the Clear Features selection, Disk Graphics does a double-check to make sure it's okay to clear memory. (It clears Features, not chart definition.):

```
ABOUT TO CLEAR FEATURES!

1.   CANCEL REQUEST TO CLEAR
2.   OK TO CLEAR
PRESS CHOICE NUMBER
(BREAK OR ENTER FOR MAIN MENU)
```
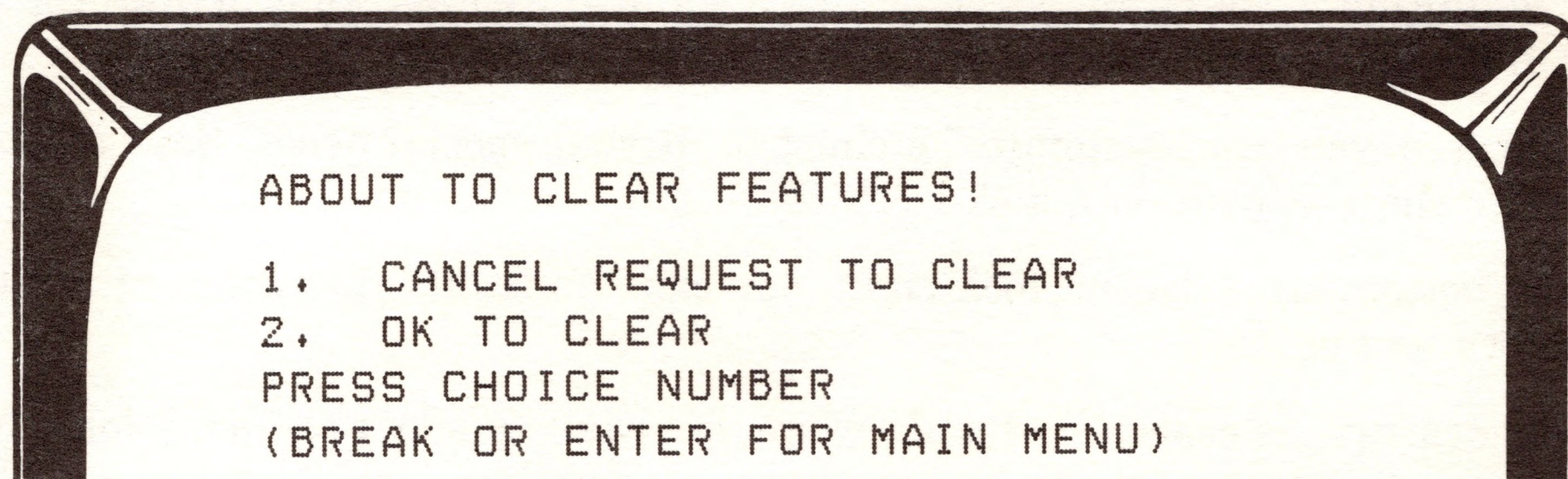
Disk Graphics keeps track of where the first Feature generated from your definition is stored. When you "Revise a Chart", the revised Features are stored in the same place on disk, replacing the previous Features that were stored there.

However, if you use Edit Features (Menu Selection: ⑤) and change a Feature, Disk Graphics is no longer sure where the first Feature is located. So, Disk Graphics assumes you have "customized" a chart, and all subsequent Features generated from your definition are added to the end of the list of Features. To avoid this, use Clear Features before revising a chart. Otherwise, your revised chart will be "superimposed" over the original.

To edit the Features, from the Main Menu, press: ⑤ (EDIT FEATURES). The first Feature is displayed. If there are no Features stored, the following will be displayed:

```
END OF FEATURES OR COMMENTS [0]

TYPES:
 0=END OF FEATURES (DELETE)
 1=COMMENTS (INSERT)
 2=SET DEFAULTS
 3=RECTANGLE
 4=TEXT
 5=POINT
 6=LINE (CONTINUATION)
 7=LINE (SEPARATE)
 8=DEFINE CIRCLE
 9=DRAW AN ARC
[                            ]
```
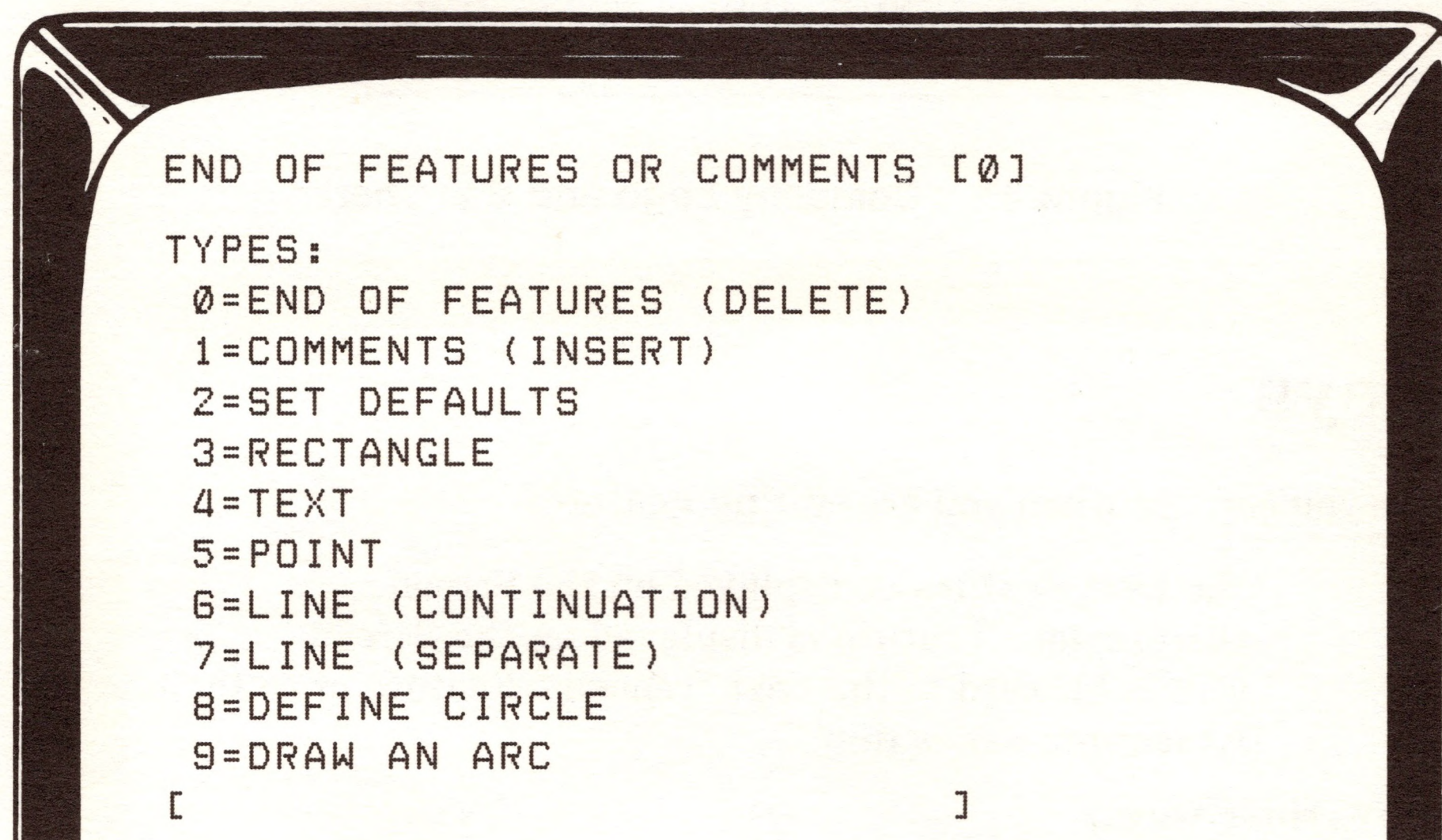
These 10 items (0 through 9) on the Screen are the types of Features:

- 0=END OF FEATURES (DELETE) Indicates that no additional Features follow.

- 1=COMMENTS (INSERT) This Feature is used only for reference. A comment Feature is generated at the beginning of every chart.

- 2=SET DEFAULTS Set Defaults is used to specify the size, color, and pitch of all subsequent points and lines. To get these prompts, press: ②.

```
SET DEFAULTS                        [2]

POINTS:
   COLOR                            [0]
   SIZE                             [0]
LINES:
   COLOR                            [0]
   PITCH                            [0]
```

- 3=RECTANGLE Rectangle draws a rectangle of any size and color. To get these prompts, press: ③.

```
DRAW A BOX                          [3]

LOWER-LEFT COORDINATES
      X                         [00000]
      Y                         [00000]
COLOR                               [0]
PITCH                               [0]
HEIGHT                          [00000]
WIDTH                           [00000]
SHADING                             [0]
```

- 4=TEXT Text String is used to print text in any size, color, or direction. To get these prompts, press: ④.

```
TEXT STRING                         [4]

START COORDINATES
      X                         [00000]
      Y                         [00000]
COLOR                               [0]
SIZE                                [0]
DIRECTION                           [0]
TEXT
[                                       ]
```

- 5=POINT Point works with the "Set Defaults" feature by drawing a small square at the coordinates specified. Size and color are set with the "Set Default" feature. To get these prompts, press: ⑤.

```
DRAW A POINT                        [5]

COORDINATES
      X                         [00000]
      Y                         [00000]
```

- 6=LINE (CONTINUATION) Line Continuation draws a line from the last location used to the location specified. The line's color and pitch are set with the "Set Defaults" Feature. To get these prompts, press: 6.

```
DRAW LINE FROM LAST POINT              [6]

DESTINATION COORDINATES
     X                                 [00000]
     Y                                 [00000]
```

- 7=LINE (SEPARATE) Line Separate draws a line from one specified location to another (with you supplying the start and end coordinates). No points are drawn. To get these prompts, press: 7.

```
DRAW SEPARATE LINE                     [7]

START COORDINATES
     X                                 [00000]
     Y                                 [00000]
END COORDINATES
     X                                 [00000]
     Y                                 [00000]
COLOR                                  [0]
PITCH                                  [0]
```

- 8=DEFINE CIRCLE Circle is used to specify the center location, radius, and starting angle of a circle. To get these prompts, press: 8.

```
DEFINE A CIRCLE                        [8]

CENTER LOC:
     X                                 [00000]
     Y                                 [00000]
RADIUS                                 [00000]
STARTING ANGLE                         [00000]
```

- 9=DRAW AN ARC Arc draws a pie section, starting at the last angle used and continuing counterclockwise for the number of degrees specified. The arc can be offset from the center of the defined circle, if you wish. To get these prompts, press: 9.

```
DRAW AN ARC                            [9]

DEGREES                                [00000]
COLOR                                  [0]
OFFSET                                 [00000]
SHADING                                [0]
```

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Feature Exceptions

Note that changes in the Features on the Screen do not affect what is stored on disk unless (ENTER) is pressed, with these two exceptions:

- **Feature type to 1** If you change the Feature type to 1, a remark Feature is stored on disk ahead of the current Feature. You can then change this stored Feature to any other type.

      END OF FEATURES OR COMMENTS   [1]

- **Feature type to 0** If you change the type to 0, the current Feature is deleted from disk and the next Feature is displayed.

Any other change to the Feature type changes the format of the Screen but does not affect what is stored on disk. Pressing (ENTER) causes the current Feature to be replaced by the one on the Screen.

Text Direction

Text can be displayed/printed in one of four directions:

0 = bottom to top

1 = left to right (standard printing direction)

2 = top to bottom

3 = upside down from right to left

Practice Session

Now use Edit Features to create your own drawing:

1. Clear Features. Type: ①②.
2. From the Main Menu, press: ⑤④.
3. From the Text String Prompts, enter 180 for the START COORDINATE: X and 140 for the START COORDINATE: Y.
4. For COLOR, press: ①; for SIZE: ②; and for DIRECTION: ③.
5. For TEXT, enter (in uppercase letters): GRAPHIC (ENTER).
   Now press: ③.
6. For the Box Prompts, enter 90 for the LOWER-LEFT COORDINATE: X and 50 for the LOWER-LEFT COORDINATE: Y.
7. For COLOR, type: 2; for HEIGHT: 50; for WIDTH: 80; and for SHADING: 1 (ENTER). Now press: ⑦.

8. From the Separate Line Menu, enter: `20` for the `START COORDINATE: X` and `16` for the `START COORDINATE: Y`. For the `END COORDINATE: X`, enter: `240`. For the `END COORDINATE: Y`, enter: `180`. Press `ENTER` `BREAK` and you're back at the Main Menu.

Now display the results on the Screen. You'll have a box, a diagonal line, and the word `GRAPHIC` displayed on the Screen. GRAPHIC is displayed with Text Direction 3 (upside down from right to left).

Creating a Logo

Create a logo under a Line Chart. First clear memory, and then plot a new chart of the apartment unit starts for Western Builders Inc. over a 10-month period (due to a shortage of space, type only the first letter in the name of each month): 603, J(une); 772, J(uly); 505, A(ugust); 503, S(eptember); 383, O(ctober); 396, N(ovember); 513, D(ecember); 299, J(anuary); 323, F(ebruary); and 546, M(arch).

Make the chart size 191 (height) and 255 (width). Position the chart on the Superscreen at 60 (up) and 130 (right). After the chart is entered, press `BREAK` to get back to the Main Menu.

Western Builders Inc. is a subsidiary of ACME STEEL and uses the sales slogan: "We're building this one for you!" This is how their logo looks.

"We're building this one for you!"

```
┌─────────────────────────────────┐
│WESTERN BUILDERS INC.            │
└─────────────────────────────────┘
```

a subsidiary of ACME STEEL

Figure 32. Logo

You can see that this logo uses a rectangle with the firm's name and two lines of text. To create this logo:

1. From the Main Menu, press: ⑤. Press →. This will advance you to the end of the Features that were generated for your chart.
2. Press ③ (this selects the box/rectangle option). For the lower-left coordinates, enter `130` for X and `25` for Y. For the height, type: `19`. For the width, type: `261`. (This means the rectangle will have a height of 19 Superscreen Points and a width of 261.) Press `ENTER`.
3. Press: ④. Now enter the name of the company inside the rectangle by giving the proper coordinates. For the Starting Coordinates, type: `133` for X and `27` for Y. For Color, press: ①; Size, ①; and Direction, ①. For Text, type: `WESTERN BUILDERS INC.` `ENTER`.
4. Press: ④. Now enter the slogan. For the Starting Coordinates, type: `155` for X and `48` for Y. For Direction, press: ①; for Text, type: `"WE'RE BUILDING THIS ONE FOR YOU!"` `ENTER`.
5. Press: ④. Now enter the "`SUBSIDIARY`" text. For the Starting Coordinates, type: `180` for X and `15` for Y. For Direction, press: ①. For Text, type: `A SUBSIDIARY OF ACME STEEL` `ENTER` `BREAK`.

Display the chart on your high-resolution Screen (set the Image Size Reduction to 1 so you can see the entire chart). If you have a printer, go ahead and print the chart (after displaying it with no reduction).

If you want an example of a more sophisticated logo, see Appendix C, **Features Logo**.

About Getting Logos Just Right . . .

As you can see from drawing this logo, to get the exact coordinates and spacing in a logo (especially if the text is centered in the logo as it is in the previous example), you'll have to experiment and use some "trial and error" before you'll get the coordinates just right.

You'll also probably want to change the size of the logo when you display or print it. Be sure to save each set of Features on a disk work file so you'll have a permanent copy that you can re-use or edit.

Tips On Drawing Feature Displays:

1. Draw out the dimensions of your chart on a piece of paper.
2. Figure the coordinates of each part of your Feature display/logo by roughly "plotting" the display on the paper.
3. Enter the coordinates.
4. If the display is still not like you want it, edit the Features.
5. Character size is 6 points wide by 10 high for size 0, 12 x 20 for size 1, 18 x 30 for size 2, etc.

Memory and Chart's Features

You should clear the memory of the previous chart's features before starting to create a new chart so you'll eliminate the traces of any previous chart that you have created.

From the Main Menu (Menu Selection: 1), you can clear the chart's features. To do this, press:

1. From the Main Menu: ①.
2. From the Double-Check Prompt: ②, and you'll be returned to the Main Menu. If you decide you no longer want to clear features, press: ①, (BREAK), or (ENTER) and you'll be returned to the Main Menu.

   Note: This does not affect the stored chart definition.

Editing Features

As mentioned earlier, features are stored on a disk work file. Whenever you insert, delete, or change the size of a feature, all of the remaining features must be shifted up or down in the disk file to make room. If you have more than 256 bytes of features, this will result in disk I/O activity. In spite of this, the delay is usually minimal.

The disadvantage of using disk is offset by the fact that you can work up to 64K bytes of features at one time (disk capacity permitting). Since a few hundred to perhaps a thousand bytes is typical, you should never run out of room.

12/ Saving and Loading (Diskette and Cassette)

There are two types of files you can save on diskette or cassette:
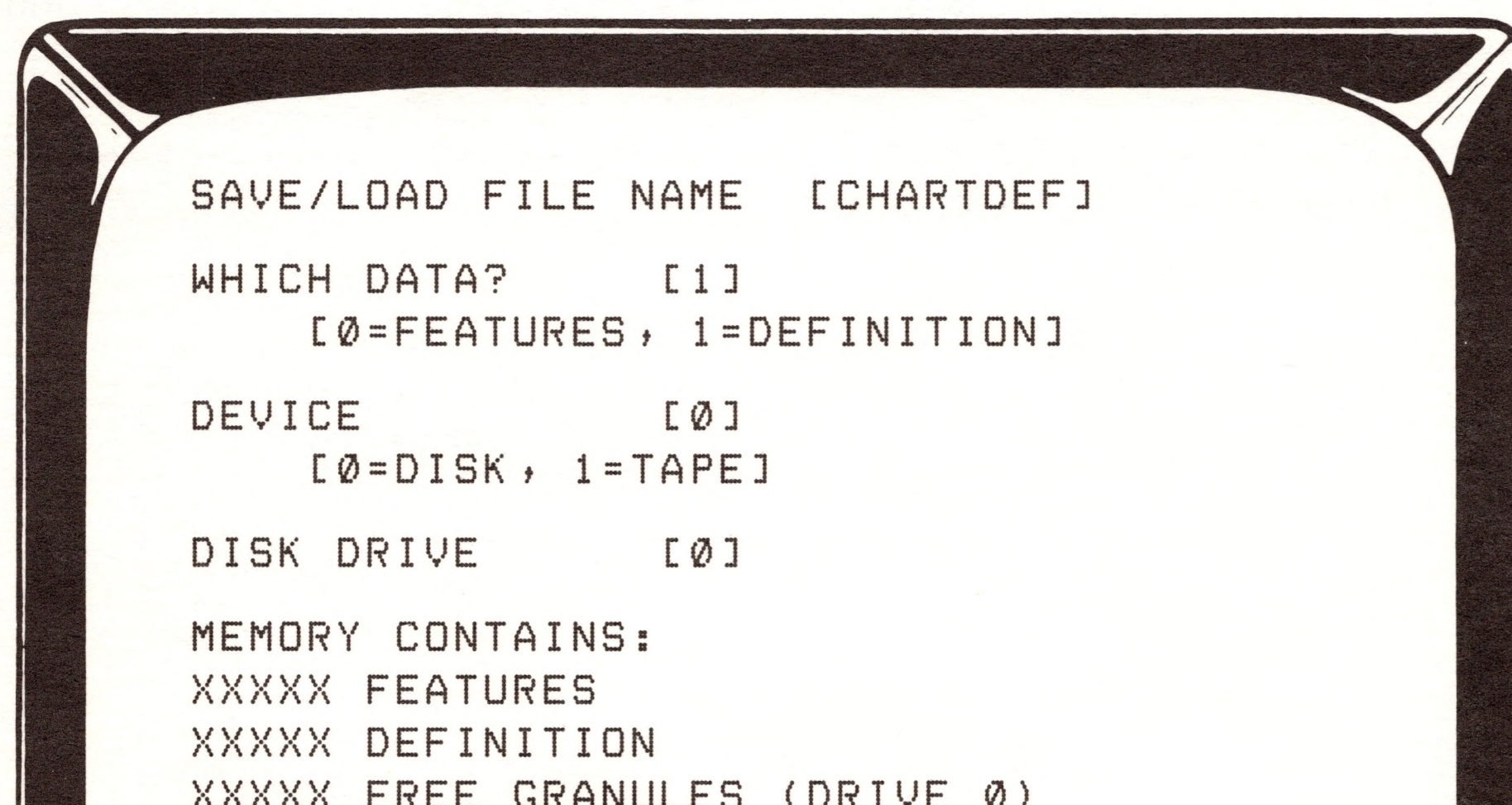
- Chart Definitions
- Chart Features

Both have slightly different procedures for loading and saving.

Saving and Loading a Chart Definition File

To save or load a chart definition file on disk:

1. Display the Main Menu and press: ④ for the SAVE prompts or ③ for LOAD. These SAVE/LOAD prompts will appear on your Screen.

```
SAVE/LOAD FILE NAME   [CHARTDEF]

WHICH DATA?      [1]
     [0=FEATURES, 1=DEFINITION]

DEVICE           [0]
     [0=DISK, 1=TAPE]

DISK DRIVE       [0]

MEMORY CONTAINS:
XXXXX FEATURES
XXXXX DEFINITION
XXXXX FREE GRANULES (DRIVE 0)
```

SAVE/LOAD FILE NAME Disk Graphics has a default filename (CHARTDEF) already entered, if you want to use it. If not, enter your own filename.

WHICH DATA? When saving/loading a Chart Definition, this variable must be "1" (the default).

DEVICE — Since you will normally be saving and loading on disk, Disk Graphics contains a default of zero (disk). You only need to change it to 1 if you want to save or load on cassette tape.

DISK DRIVE — There is a default of zero, since it is more convenient to keep most of your charts on the same diskette as the program. This can be changed if you want to save or load from another Disk Drive.

MEMORY CONTAINS The Save/Load Prompts show you how much Features and Chart Definition data is currently in memory (in bytes). You can also see how much free space (in grans) is on Drive 0.

2. After answering the Save/Load Prompts, press (ENTER).

If you just saved a Chart Definition file, you'll be returned to the Main Menu. If you just loaded a Chart Definition file, the program will automatically go through the chart definition procedure to generate features before returning to the Main Menu.

Saving and Loading a Features File

Saving and loading a Features file is just like saving/loading a Chart Definitions file, except you change the WHICH DATA? prompt to 0 (for "Features"):

```
WHICH DATA?        [0]
   (0=FEATURES, 1=DEFINITION)
```

Also, after a features file has been saved or loaded, you'll be returned to the Main Menu.

Disk Graphics adds a file name extension of /DEF to all Chart Definition files and /FEA to all Features files. This makes the difference more obvious on a display of the disk directory (see the Color Computer Disk System Manual) and helps insure that a Chart Definition file is not loaded as if it were a Features file.

You should be aware of the fact that Chart Definitions and Features require twice as much disk space in your files as they do in the work files. This is important only if you are working with very big files.

Important Note: If the system "hangs up" for any reason, press the RESET button on the back of the Color Computer. When the message, "FILE NOT CLOSED AFTER CHANGES," appears on the Screen, press (ENTER) to return to the Disk Graphics program.

Be sure to name each file with a different name. To keep the Features and Chart Definitions files and cassettes organized, you might want to keep a log.

Appendix A/ Graphic Error Messages

When you get an error message, Disk Graphics clears your entire Screen, the error number is displayed (for looking up suggested actions in this appendix), and a one- or two-line description of the error is shown. For example, error #1 says, "NOT TALL ENOUGH FOR DESCRIPTIONS". This should minimize the time spent looking up errors in the manual.

Note: Most errors encountered while defining a chart must be corrected before you can return to the Main Menu.

Check this table for solutions:

Number	Description
1	**NOT TALL ENOUGH FOR DESCRIPTIONS.** Pie Chart too short. A minimum of 10 points of chart height is needed for the title and each line of description. Options: Make the chart taller or use fewer sections.
2	**NOT WIDE ENOUGH FOR TITLE.** Title too big. A minimum of 6 points of width is required for each letter and space. Options: Make the chart wider or use a shorter title.
3	**NOT WIDE ENOUGH FOR DESCRIPTION.** Pie Chart's section description too long. Options: Make the chart wider. Make your longest section description shorter. Eliminate the percentage sign (if used), or use lines instead of letters to connect the descriptions to the slices.
4	**NOT TALL ENOUGH FOR SIDE LABEL.** Chart not tall enough for left label. Options: Make the chart taller or use a shorter label.
5	**NOT WIDE ENOUGH FOR SIDE LABEL.** Chart not wide enough for left label. Options: Make the chart wider. Use a longer side label (forcing a smaller size type), double space, or eliminate the Side Label.
6	**NOT WIDE ENOUGH FOR BOTTOM LABEL.** Chart not wide enough for bottom label. Options: Make the chart wider or use a shorter label.
7	**NOT TALL ENOUGH FOR BOTTOM LABEL.** Chart not tall enough for bottom label. Options: Make chart taller or eliminate the Bottom Label. You may be able to force a smaller type size by using a longer label or double spacing.
8	**NOT WIDE ENOUGH FOR PERIOD LABELS.** Period titles too long. Options: Shorten your longest bar label, use fewer periods, or make the chart wider.

Number	Description
9	**NOT TALL ENOUGH FOR BARS.** Chart not high enough to draw bars. There are less than 10 points left for the chart. Options: Make the chart taller or eliminate the Bottom Label.
10	**ALL BAR HEIGHTS ARE ZERO.** Maximum height is zero. Disk Graphics "suggested" a value of 1 for each bar, but you changed them to zero. Solution: Supply at least one value greater than zero.
11	**NOT WIDE ENOUGH FOR ALL BARS.** Chart not wide enough for all bars. Each bar must be at least 3 points wide with a space of one point between bars. Options: Use fewer "items/period," fewer periods, or make the chart wider.
12	**NOT BIG ENOUGH FOR PIE.** Not enough room for Pie Chart's circle. A circle must have a radius of at least 5. Options: Make the chart larger or make the largest offset value smaller.
13	**TOTAL OF PIE SLICES IS ZERO.** Total of values for all slices is zero. A minimum of 1 was "suggested" for each slice, but you changed them all to zero so percentages can't be calculated. Solution: Go back and enter a value that's greater than zero.
14	**NOT TALL ENOUGH FOR DESCRIPTIONS.** Horizontal Bar Chart not tall enough for period descriptions. Options: Make the chart taller or use fewer periods.
15	**NOT WIDE ENOUGH FOR DESCRIPTIONS.** Horizontal Bar Chart not wide enough for widest description. The longest period label on a Horizontal Bar Chart requires more than 1/2 the chart width. Options: Make the longest description shorter or make the chart wider.
16	**NOT TALL ENOUGH FOR ALL KEY LINES.** Key Chart not tall enough for all lines in key. Options: Make the Key Chart taller, eliminate the Bottom Label, or describe fewer items in your chart.
17	**NOT WIDE ENOUGH FOR KEY LINES.** Key Chart not wide enough for longest key line. Make your Key Chart wider, eliminate the Side Label, or shorten the longest description line.
18	**MAX HORIZONTAL POINT VALUE IS ZERO.** Maximum horizontal point position is zero. A value of 1 was suggested for all points but you changed them all to zero. Solution: Supply at least one value greater than zero.
19	**MAX VERTICAL POINT VALUE IS ZERO.** Maximum vertical point position is zero. A value of 1 was suggested for all points but you changed them all to zero. Solution: Supply at least one value greater than zero.

Number	Description
20	**CAN'T EXPAND DEFINITION FILE.** No room to expand Definition Work File. Definition was deleted. You ran out of free space on Drive 0. Options: Exit the program and clean up your files. KILL those that you no longer need or COPY some to another disk and then KILL them. You might be able to pick up some free space by KILLing DEFWORK1/WRK, DEFWORK2/WRK, and FEAWORK/WRK if they have more than 1 gran assigned to each.
21	**CAN'T EXPAND FEATURE FILE.** No room to expand Feature Work File. Last chart's Features were deleted. You ran out of free space on Drive 0. Options: Exit the program and clean up your files. KILL those that you no longer need or COPY some to another disk and then KILL them. You might be able to pick up some free space by KILLing DEFWORK1/WRK, DEFWORK2/WRK, and FEAWORK/WRK if they have more than 1 gran assigned to each.
22	**CAN'T EXPAND FEATURE WORK FILE.** No room on Drive 0 to expand Work File. You ran out of free space on Drive 0 while editing features. Options: Your request to insert a new feature or to change an existing feature was ignored. You must create at least 1 gran of free space on disk before these actions will be allowed. Exit the program and clean up your files. KILL those that you no longer need or COPY some to another disk and then KILL them. You might be able to pick up some free space by KILLing DEFWORK1/WRK, DEFWORK2/WRK, and FEAWORK/WRK if they have more than 1 gran assigned to each.

Appendix B/ Graphic Terminology/Range Summary

Name	Range	Definition
bottom label	—	Text description on the bottom side of chart.
chart height	1-999	Determines the height of a chart.
chart position	1-999	Determines the position of the chart on the Superscreen (up: vertical, right: horizontal).
chart width	1-999	Determines the width of the chart.
color	0-3	Determines color.
description	—	Text used as description for each section/line/bar.
erase	0-1	Erases; use when putting a chart on top of another.
image size reductions	0-3	Determines the size of the image that appears.
items/period	1-255	Number of items in a period.
line color	0-3	Determines the color of a line.
line pitch	0-7	Only for Color Graphics Printer — determines the "line style" of a line.
name of period	—	Text description of a period.
number of slices	0-255	Determines the number of sections in a pie.
offset	0-250	Determines how many "graphic points" a pie section is "offset" from the pie.
periods	1-255	Number of bars, lines, or Key Chart descriptions.
percent	0-1	Determines if pie section descriptions have percentages shown.
pitch	0-7	Determines the "style" of a line.
point color	0-3	Determines the color of a point on a Line Chart.
point size	0-9	Determines the size of a point on a Line Chart.
reference	0-1	Determines whether letters or lines are used to reference pie sections.
scale lines	0-1	Prints increment (or "scale") lines on Bar and Line Charts.
shading	0-1	Sets shading for all sections/lines/bars.
shading exception	0-1	Sets shading for one section/line/bar to the opposite of the general rule (see Shading).
side label	—	Text description on the side of a chart.
size	1-30,000	Determines the size of a pie section.
value of period	1-30,000	Determines the height of a line or the size of a bar.

Appendix C/ Features Logo

You'll probably want to create some very sophisticated logos, seals, etc., and use these displays over and over again on your charts. Here's an example of a logo:

```
 ╔════════════════════════════════════════╗
 ║  ░█░  ACME                              ║
 ║       CREATIVE GRAPHICS                 ║
 ║       of Kansas                         ║
 ║       "What can we create for you?"     ║
 ╠════════════════════╦═══════════════════╣
 ║  1911 N. Elm       ║   33rd & I-35      ║
 ║  TOPEKA            ║   WICHITA          ║
 ╠════════════════════╩═══════════════════╣
 ║   Call us toll free 1-800-555-5309!     ║
 ╚════════════════════════════════════════╝
```
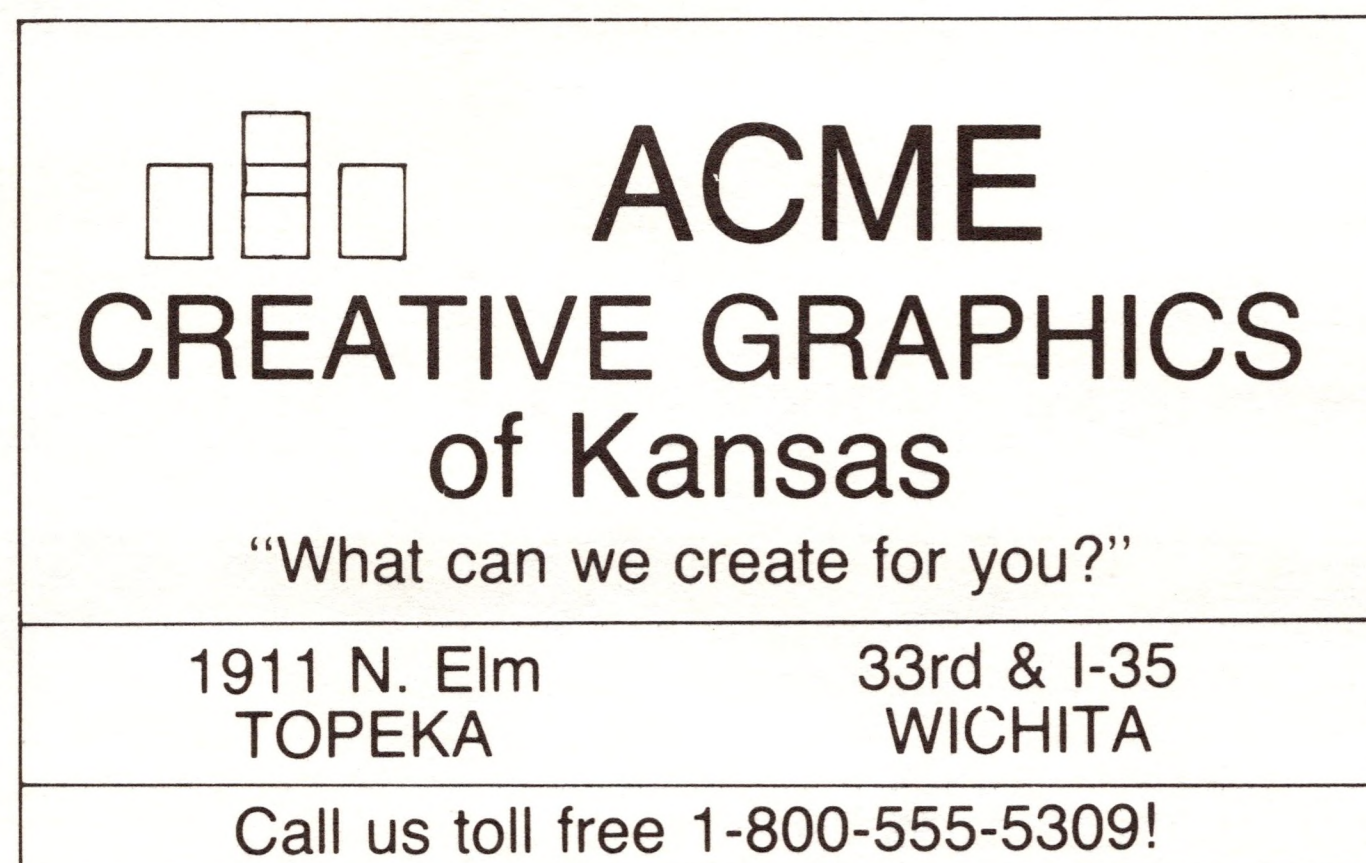
To create this logo, follow these steps:

1. Draw the logo on a piece of paper, roughly figuring how large you want each part of the logo to be (as well as color and point size).
2. Decide what "type" of Feature each part of the logo is.
3. Enter the Feature values into Disk Graphics.

Here are the displays on how you might create the logo:

```
DRAW A BOX                                  [3]
LOWER-LEFT COORDINATES
     X                                [00010]
     Y                                [00000]
COLOR                                     [0]
PITCH                                     [0]
HEIGHT                                [00140]
WIDTH                                 [00211]
SHADING                                   [0]
```

```
TEXT STRING                                 [4]
START COORDINATES
     X                                [00100]
     Y                                [00102]
COLOR                                     [0]
SIZE                                      [2]
DIRECTION                                 [1]
TEXT
[ACME                                        ]
```

```
TEXT STRING                                [4]
START COORDINATES
        X                                  [00026]
        Y                                  [00050]
COLOR                                      [0]
SIZE                                       [0]
DIRECTION                                  [1]
TEXT
["WHAT CAN WE CREATE FOR YOU?"                     ]
```

```
TEXT STRING                                [4]
START COORDINATES
        X                                  [00029]
        Y                                  [00020]
COLOR                                      [0]
SIZE                                       [0]
DIRECTION                                  [1]
TEXT
[TOPEKA                                            ]
```

```
TEXT STRING                                [4]
START COORDINATES
        X                                  [00020]
        Y                                  [00030]
COLOR                                      [0]
SIZE                                       [0]
DIRECTION                                  [1]
TEXT
[1911 N. ELM                                       ]
```

```
TEXT STRING                                [4]
START COORDINATES
        X                                  [00155]
        Y                                  [00020]
COLOR                                      [0]
SIZE                                       [0]
DIRECTION                                  [1]
TEXT
[WICHITA                                           ]
```

```
TEXT STRING                               [4]
START COORDINATES
     X                                [00144]
     Y                                [00030]
COLOR                                 [0]
SIZE                                  [0]
DIRECTION                             [1]
TEXT
[33RD & I-35                               ]
```

```
TEXT STRING                               [4]
START COORDINATES
     X                                [00015]
     Y                                [00008]
COLOR                                 [0]
SIZE                                  [0]
DIRECTION                             [1]
TEXT
[CALL US TOLL FREE 1-800-555-5309!         ]
```

```
TEXT STRING                               [4]
START COORDINATES
     X                                [00015]
     Y                                [00080]
COLOR                                 [0]
SIZE                                  [1]
DIRECTION                             [1]
TEXT
[CREATIVE GRAPHICS                         ]
```

```
TEXT STRING                               [4]
START COORDINATES
     X                                [00070]
     Y                                [00065]
COLOR                                 [0]
SIZE                                  [1]
DIRECTION                             [1]
TEXT
[OF KANSAS                                 ]
```

```
DRAW A BOX                               [3]
LOWER-LEFT COORDINATES
     X                             [00030]
     Y                             [00100]
COLOR                              [0]
PITCH                              [0]
HEIGHT                             [00015]
WIDTH                              [00010]
SHADING                           [0]
```

```
DRAW A BOX                               [3]
LOWER-LEFT COORDINATES
     X                             [00045]
     Y                             [00100]
COLOR                              [0]
PITCH                              [0]
HEIGHT                             [00015]
WIDTH                              [00010]
SHADING                           [0]
```

```
DRAW A BOX                               [3]
LOWER-LEFT COORDINATES
     X                             [00060]
     Y                             [00100]
COLOR                              [0]
PITCH                              [0]
HEIGHT                             [00015]
WIDTH                              [00010]
SHADING                           [0]
```

```
DRAW A BOX                               [3]
LOWER-LEFT COORDINATES
     X                             [00045]
     Y                             [00110]
COLOR                              [0]
PITCH                              [0]
HEIGHT                             [00015]
WIDTH                              [00010]
SHADING                           [0]
```

```
DRAW A BOX                                    [3]
LOWER-LEFT COORDINATES
     X                                   [00010]
     Y                                   [00000]
COLOR                                    [0]
PITCH                                    [0]
HEIGHT                                   [00140]
WIDTH                                    [00211]
SHADING                                  [0]
```

```
DRAW SEPARATE LINE                            [7]
START COORDINATES
     X                                   [00010]
     Y                                   [00040]
END COORDINATES
     X                                   [00219]
     Y                                   [00040]
COLOR                                    [0]
PITCH                                    [0]
```

```
DRAW SEPARATE LINE                            [7]
START COORDINATES
     X                                   [00010]
     Y                                   [00016]
END COORDINATES
     X                                   [00219]
     Y                                   [00016]
COLOR                                    [0]
PITCH                                    [0]
```

Appendix D/ Disk Data Formats

If you wish to read or write disk or tape files with a BASIC program, these are the things you will need to know. It assumes an advanced knowledge of programming and is somewhat technical.

General

All tape files written by this program are ASCII files. (Tape files include a leader on every block. Output tape blocks are never more than 128 bytes in length; however, input files may contain up to 255 bytes per block.)

The same technique is used when reading and writing both types of files (definitions or features). It is a hybrid technique that allows both binary and ASCII data to be written to the same diskette or tape file (feature files contain binary data). Basically, it consists of writing as if it were a binary file, but with a hex 0D character inserted after every byte. With a little effort, BASIC can both read and write compatible files.

This must be taken into account when reading and writing these files. To read such a file, every INPUT statement will yield a single character string. If a ⬇ or ⏎ENTER is read, BASIC will see a null string. In this case, a second INPUT must be done.

When writing such a file, each character must be printed separately. A PRINT CHR$(10) or PRINT CHR$(13) must be followed by a simple PRINT statement.

Although this may sound involved, simple subroutines can be used to read or write a string using FOR X=1 TO STRLEN A$ and the MID$ statements. (Look at the sample program in Appendix E and it will soon become clear to you how such subroutines are utilized.)

Chart Definition Files

A definition file basically contains a list of the keystrokes that would have to be typed in order to create the chart by hand. The first character is the response to the TYPE OF CHART menu. This is followed by the title, etc. At the end of each item, there is a downarrow character (10 decimal or "0A" hex). After the last item of a data display, there is an ⏎ENTER character (13 decimal).

Bear in mind the recording technique discussed above. Every character mentioned here is followed by a 0D hex, including ⏎ENTER characters. (⏎ENTER is recorded as two consecutive ⏎ENTER characters.)

Definition files also contain a few other control bytes. The ENTER byte synchronizes the processing of each data input display. However, after a series of the same type of display where the number of occurrences is variable (such as entering PERIOD labels), a special SYNC byte is inserted (254 decimal, FE hex). This allows the program to respond correctly when you change the number of periods, for example. This SYNC byte is also used after the last data input screen for each period for bar charts, since each period can contain a variable number of bars.

Finally, the chart definition is terminated by a 255 decimal (FF hex) byte. When encountered, any additional keystrokes required to define a chart must come from the keyboard. (In fact, when starting a new chart definition, you are actually "revising" a previous definition that consists of only a 255 decimal byte.)

Feature Files

Features are stored in the work files in binary and recorded in your disk or tape files as described. There are 10 types of features. Their internal formats are as follows:

Type 1 — remarks

Byte 0 = 01 hex (feature type)
Bytes 1-n = any length text string up to 255 bytes
Last byte = 0D hex

Type 2 — set defaults

Byte 0 = 02 type
Byte 1 = 00-03 point color
Byte 2 = 00-09 point size
Byte 3 = 00-03 line color
Byte 4 = 00-09 line pitch

Type 3 — draw a box

Byte 0 = 03 type
Bytes 1-2 = X-coordinate of lower-left corner
Bytes 3-4 = Y-coordinate of lower-left corner
Byte 5 = 00-03 box color
Byte 6 = 00-09 pitch
Bytes 7-8 = box height
Bytes 9-10 = box width
Byte 11 = 00-01 shaded (1 = shaded)

Type 4 — text string

Byte 0 = 04 type
Bytes 1-2 = starting X-coordinate
Bytes 3-4 = starting Y-coordinate
Byte 5 = 00-03 color
Byte 6 = 00-09 size
Byte 7 = 00-03 direction
Bytes 8-n = text string (up to 255 characters)
Last byte = 0D

Type 5 — draw a point

Byte 0 = 05 type
Bytes 1-2 = X-coordinate of center
Bytes 3-4 = Y-coordinate of center

Type 6 — draw a line continuation

Byte 0 = 06 type
Bytes 1-2 = X-coordinate of destination
Bytes 3-4 = Y-coordinate of destination

Type 7 — draw a discrete line

Byte 0 = 07 type
Bytes 1-2 = X-coordinate of starting location
Bytes 3-4 = Y-coordinate of starting location
Bytes 5-6 = X-coordinate of ending location
Bytes 7-8 = Y-coordinate of ending location
Byte 9 = 00-03 color
Byte 10 = 00-09 pitch

Type 8 — define a circle

Byte 0 = 08 type
Bytes 1-2 = X-coordinate of center
Bytes 3-4 = Y-coordinate of center
Bytes 5-6 = 0001-00FF radius
Bytes 7-8 = 000-0167 (359 decimal) starting angle

Type 9 — draw an arc

Byte 0 = 09 type
Bytes 1-2 = 0000-0168 (360) degrees
Byte 3 = 00-03 color
Bytes 4-5 = 0000-00FF offset
Byte 6 = 00-01 shaded

Type 0 — end of features

Byte 0 = 00 type

# Data Compatibility Between Disk and ROM Versions

Data stored by Disk Graphics on tape AND disk are in the same format as the ROM version of Graphic (26-3157). All Chart Definitions stored on tape with the ROM program can be loaded into the disk program.

Even though the disk program asks for more data for each point on Line Charts, Line Chart Definitions created with the ROM program will still load and work properly. The reverse, however, is not true. A Line Chart Definition created with the disk program will not work in the ROM program unless the item values are repeated in the MINIMUM prompt. (The ROM program will attempt to "enter" all three values with a ⊤ between them. This will result in "beeps" for the extra ⊤'s and the last value entered, MINIMUM, will end up being the value used.)

Point Chart Definitions should not be saved on tape for use in the ROM program. However, the Point Chart's Features can be saved on tape and will produce the same results if loaded into the ROM program! The same applies to MAX/MIN Line Charts.

Appendix E/ Sample Program

The following program is stored on the program diskette as "BASDEF/BAS". Its output is "BASDEF/DEF" which is usable by Disk Graphics. Lines 60 through 300 are standard output routines to include in any BASIC program that writes a Chart Definition file. The Point Chart created by this program is illustrated below.
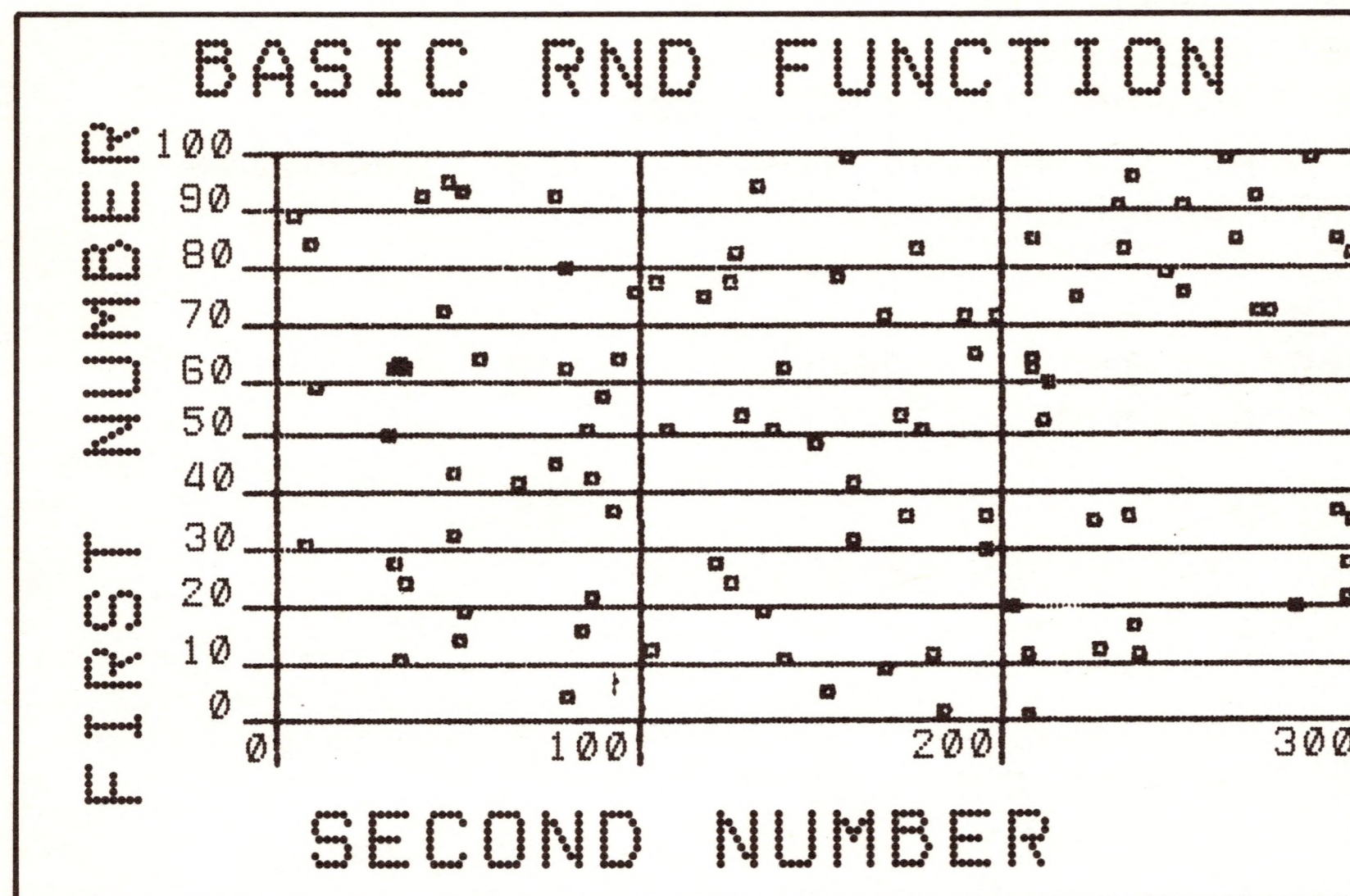

```
10  REM*****************************
20  REM* SAMPLE PROGRAM THAT CREATES A
30  REM* POINT CHART FROM GENERATED DATA
40  REM*****************************
50  GOTO 1000
60  REM* OUTPUT ROUTINE FOR A NUMBER
70  REM* GIVEN: I
100 GOSUB 110:Z$=Z1$:GOTO 200
105 *REM*EDIT I INTO THE STRING, Z1$
110 Z1$=""
115 I1=INT(I/10):I2=I-I1*10:I=I1
120 Z1$=CHR$(I2+48)+Z1$
130 IF I > 0 THEN 115
140 RETURN
150 REM* OUTPUT ROUTINE FOR TEXT
160 REM* GIVEN:Z$ (">" INDICATES DOWNARROW)
200 FOR Z=1TOLEN(Z$)
210 Z1$=MID$(Z$,Z,1):GOSUB 250:NEXT Z
225 IF ASC(Z1$)>253 THEN RETURN
230 Z1$="":GOSUB 250:RETURN
250 IF Z1$=">" THEN Z1$=CHR$(10)
260 IF Z1$="" THEN GOSUB 270
265 REM THIS IS THE ONLY PRINT STMT
270 PRINT#1,Z1$:RETURN
280 REM* SEND SYNC BYTE
```

```
290 Z1$=CHR$(254):GOTO 200
295 REM* SEND EOF BYTE
300 Z1$=CHR$(255):GOTO 200
900 REM
910 REM*****************************
920 REM USER PROGRAM LOGIC STARTS HERE
930 REM*****************************
1000 CLS:PRINT "GENERATING CHART"
1010 OPEN "O",#1,"BASDEF/DEF"
1020 REM DEFINE THE BASICS
1030 Z$="GBASIC RND FUNCTION":GOSUB 200
1040 Z$="FIRST NUMBER > SECOND NUMBER > 100":GOSUB 200
1050 REM GENERATE 100 POINTS
1060 FOR N=1 TO 100
1061 PRINT @ 128,N;
1070 X1=RND(30000):X=INT(X1/100):Y=X1-X*100
1080 I=X:GOSUB 110:REM CHG TO TEXT
1090 Z$=Z1$
1100 I=Y:GOSUB 110
1110 REM COMBINE FOR SCREEN DATA STRING
1120 Z$=Z$+">"+Z1$
1130 GOSUB 200
1140 NEXT N
1150 GOSUB 300: REM SEND EOF BYTE
1160 CLOSE
```